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U. S. DEPARTMENT OF AGRICULTURE  
EXPLANATORY

Fiscal Year 1948

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## FEDERAL FARM MORTGAGE CORPORATION

### Creation and Purpose

The Federal Farm Mortgage Corporation was created by the Federal Farm Mortgage Corporation Act, approved January 31, 1934 (48 Stat. 344), for the following purposes: (1) to provide funds for the making of loans to farmers by the land bank commissioner pursuant to the provisions of section 32 of the Emergency Farm Mortgage Act of 1933 (48 Stat. 48); (2) to make funds available to the Federal land banks to assist them in their financing during periods of emergency; and (3) to make loans to joint stock land banks.

### Type of Operations

The data submitted in connection with this budget reflects the principal activities of the Federal Farm Mortgage Corporation in the 1946 and 1947 fiscal years to be that of (1) providing funds for the making of land bank commissioner loans to supplement land bank loans to farmers or to finance the requirements of farmers without the assistance of land bank loans and (2) the servicing of such loans. It is assumed that the lending authority of the corporation will not be extended beyond July 1, 1947, and that the activities of the corporation during the fiscal year 1948 will be restricted to a program of liquidation.

The corporation obtains its funds from the issuance of bonds and from its Government-owned capital stock and accumulated earnings.

The Act of July 12, 1946 (Public Law 505), extends the lending authority of the Corporation to July 1, 1947. New loans to farmers will not be made during the fiscal year 1948 unless legislation is enacted extending the lending authority of the land bank commissioner beyond July 1, 1947. However, the Corporation may be required to refinance some loans closed in the name of the land bank commissioner prior to July 1, 1947 (12 U.S.C. 1016g). Such contingencies are not provided for in the 1948 budget.

Section 2 of the Act of July 12, 1946, further amends section 3 of the Federal Farm Mortgage Corporation Act, and authorized the Corporation to repay to the Secretary of the Treasury on behalf of the United States from time to time, such portions of the amounts subscribed to the capital stock of the Corporation as are found by the board of directors to be in excess of the capital necessary to enable the Corporation to carry out its functions as authorized by law. The proceeds of such repayments are to be held in the Treasury of the United States as a fund available for subscription by the Governor of the Farm Credit Administration on behalf of the United States to the capital of the Corporation. Pursuant to section 2 of the Act of July 12, 1946 (Public Law 505) referred to above, the board of directors of the Corporation has determined that as cash funds of the Corporation are accumulated in amounts of \$1,000,000 or multiples thereof in excess of the amounts required for normal operating purposes, such excess cash accumulations should be devoted to the retirement of capital.

Based on present trends in the liquidation of the Corporation's assets, it is anticipated that capital in the amount of \$40,000,000 will be retired during the fiscal year 1947 and that capital in the amount of \$9,990,000 will be retired during the fiscal year 1948.

The Act of July 12, 1946, (Public Law 505, 79th Congress) also directed the Farm Credit Administration to make a report to the Congress by March 31, 1947, on ways and means of making available to farmers throughout the Federal land bank system, loans similar to those now closed through the Federal Farm Mortgage Corporation. Action relative to this report, which has been submitted to the Congress, may of course have a material effect upon the operations of the Corporation during the fiscal year 1948.

The Federal Farm Mortgage Corporation employs no personnel, instead it utilizes the services and facilities of the Farm Credit Administration, the Federal land banks, and the national farm loan associations to perform the necessary services to carry out its corporate functions for which the agencies are reimbursed by the Corporation at cost. In addition, the Federal reserve banks and the Treasury Department perform certain fiscal services for the Corporation for which they are reimbursed.

#### Basis of Estimates

The 1948 budget estimate as submitted to the Congress is based primarily upon the individual estimates made by the 12 Federal land banks as agents for the Federal Farm Mortgage Corporation. These estimates were based on the fact that the lending authority of the Federal Farm Mortgage Corporation expires June 30, 1947, and the assumption that agricultural conditions having a bearing on the collection of loans will not change substantially and will be generally as favorable in the fiscal year 1948 as they are today.

Provision has not been made in these estimates for the costs of audits by the General Accounting Office, pursuant to Public Law 248 (79th Congress) since that office has informed the Department that bases for making such an estimate are not available at this time.

#### Summary of Operations

A summary of operations, actual for fiscal year 1946 and estimated for 1947 and 1948, which is set forth in greater detail in the printed budget, is given in the following table:

	Fiscal Year	Fiscal Year	Fiscal Year
	1946	1947	1948
	Actual	Estimated	Estimated
<u>Funds Applied</u>			
To make loans to farmers ...	\$15,519,473:	\$15,632,800:	--
To acquisition and improve- ment of acquired security			
or collateral .....	1,235,384:	555,000:	\$413,900
Operating expenses .....	5,958,203:	4,661,800:	3,303,800
To repayment of borrowings .	322,415,300:	13,214,400:	500,000
To repayment of paid-in capital to U.S. Treasury .	50,000,000:	40,000,000:	9,990,000
To investment in U.S. Govern- ment securities .....	--:	--:	25,000,000
To net increase in other assets .....	1,791:	--:	--
To increase (or decrease*) working capital .....	*626,418:	*3,677,100:	3,224,900
	<u>394,503,733:</u>	<u>70,386,900:</u>	<u>42,432,600</u>
<u>Funds Provided</u>			
By repayments of principal of loans .....	156,564,490:	61,268,700:	35,754,200
By sale of acquired security or collateral .....	2,786,312:	964,000:	507,600
By operating income .....	12,717,512:	8,020,500:	6,121,600
By nonoperating income .....	135,419:	129,700:	48,700
By borrowings: From U.S. Treasury .....	222,300,000:	--:	--
By net decrease in other assets .....	--:	4,000:	500
	<u>394,503,733:</u>	<u>70,386,900:</u>	<u>42,432,600</u>

\*Deduct



Administrative Expenses

Appropriation Act, 1947 .....	\$3,750,000
Anticipated supplemental for additional costs due to extension of lending authority - Public Law 505 .....	+800,000*
Total estimated expenses, 1947 .....	4,550,000
Budget estimate, 1948 .....	3,235,000
Decrease, 1948 .....	<u>-1,315,000</u>

\*Note: This amount appears in the 1948 Budget. However, experience to March 31, 1947, indicates that the full amount of \$3,750,000 provided for the fiscal year 1947 (which was exclusive of new loan acquisition costs) will not be required and the savings thus realized will be applied to expenses due to extension of the lending authority (Public Law 505, 79th Congress) and the supplemental estimate is being reduced to \$400,000.

The decrease of \$1,315,000 in funds required for administrative expenses of the Federal Farm Mortgage Corporation for 1948 is composed of:

- (a) An estimated decrease of \$139,170 in reimbursements to Salaries and Expenses, Farm Credit Administration for examination, supervision, and service. This decrease is due to a revision in cost-sharing ratios for the equitable distribution of the Administration's examination and supervisory costs to the banks, corporations, and other organizations operating within the Farm Credit Administration structure (12 U.S.C. 832).
- (b) A decrease of \$1,169,000 in reimbursements to the Federal land banks of which \$369,000 is applicable to loan servicing costs and the remaining \$800,000 to the cost of acquiring new loans. Due to the continued liquidation of the Corporation's assets it is estimated that the cost of the Federal land banks of servicing such assets during the fiscal year 1948 will be \$369,000 less than similar services performed during the fiscal year 1947. Also, since the authority of the Corporation to make new loans expires July 1, 1947, it is expected that the cost of acquiring new loans, estimated to be \$800,000 during the 1947 fiscal year, will not recur during the fiscal year 1948.

The Federal land banks and national farm loan associations maintain an organization and personnel equipped to handle their own business and that of the Federal Farm Mortgage Corporation. These organizations have assumed the responsibility of adequately servicing the assets of the Corporation, and in turn the Corporation reimburses the banks for services rendered by the banks and associations on the basis of costs accumulated through an adequate accounting system under which the expenses are classified between direct costs of loan acquisition, direct costs of servicing, and overhead costs. Such costs are appropriately distributed between the two organizations. A field audit of these costs is made each year by the Examination Division of the Farm Credit Administration.

- (c) A net decrease of \$6,830 in other objects of expense including reimbursements to Federal reserve banks for services rendered by the banks in the custody, shipment, and delivery of Corporation bonds and the redemption of interest coupons and the transfer to the office of the Treasurer of the United States for services performed by the Treasury Department.

There follow selected comparative data on the operations of the Federal Farm Mortgage Corporation:

Federal Farm Mortgage Corporation - selected comparative data

Item	June 30, 1944	June 30, 1945	June 30, 1946
Gross assets .....	\$631,157,926	\$346,518,150	\$199,265,848
Loans outstanding:			
Number .....	294,539	252,797	163,546
Amount .....	\$368,830,901	\$308,915,338	\$174,204,350
Loans closed during year ended:			
Number .....	17,781	22,760	15,746
Amount .....	\$31,701,354	\$40,243,955	\$14,729,530
Repayments of loans during year ended .....	\$122,313,600	\$96,860,828	<u>/a</u> \$147,188,249
Loans delinquent:			
Number .....	<u>/b</u> 20,855	<u>/b</u> 16,114	11,847
Amount .....	<u>/b</u> \$32,067,111	<u>/b</u> \$23,601,689	\$15,729,775
Percent of loans delinquent:			
Number .....	<u>/b</u> 7.1	<u>/b</u> 6.4	7.3
Amount .....	<u>/b</u> 8.7	<u>/b</u> 7.6	9.0
Real estate and sheriffs' certificates acquired during the year ended:			
Number .....	1,149	452	216
Investment .....	<u>/b</u> \$4,525,585	\$1,729,173	\$772,627
Real estate and sheriffs' certificates disposed of during the year ended:			
Number:			
Whole .....	2,546	1,610	621
Part .....	158	95	40
Investment .....	\$10,168,876	\$6,438,054	\$2,755,466
Real estate and sheriffs' certificates on hand:			
Number .....	1,816	645	239
Investment .....	\$6,923,046	\$2,646,955	\$931,775
Bonds outstanding .....	\$365,000,000	\$108,000,000	\$12,000,000
Capital stock .....	\$100,000,000	\$100,000,000	\$50,000,000

/a Includes loans sold to FLB in the amount of \$66,431,094.

/b Revised.

Language relating to administrative expenses

The estimate includes changes in the language of this item as follows (new language underscored, deleted matter enclosed with brackets):

Change  
No.

- 1 [Provided, That not] Not to exceed [\$3,750,000] \$3,235,000
- 2 (to be computed on an accrual basis) of the funds of the
- 3 Corporation shall be available for administrative expenses
- 4 [of the Corporation], including employment on a contract or
- 5 fee basis of persons, firms, and corporations for the perfor-
- 6 mance of special services, including legal services; and the  
use of the services and facilities of Federal land banks,  
national farm loan associations, Federal reserve banks, and  
agencies of the Government as authorized by the act of  
January 31, 1934 (12 U.S.C. 1020-1020h); and said total sum  
shall be exclusive of interest expense, and expenses in  
connection with the acquisition, operation, maintenance,  
improvement, protection, or disposition of real or personal  
property belonging to the Corporation or in which it has an  
interest [: Provided further, that except for the limitation  
in amount hereinbefore specified the administrative expenses  
and other obligations of the Corporation shall be incurred,  
allowed, and paid in accordance with the provisions of said  
act of January 31, 1934, as amended (12 U.S.C. 1016-1020h)].

The first, third and fourth changes are proposed for the sole purpose of shortening and simplifying the wording of the item and will not affect the present authority in any manner.

The second change specifically authorizes administrative expenses on an accrual basis as contemplated by the Government Corporation Control Act (59 Stat. 597), and payment thereof from the funds of the corporation. This practice, generally, has been followed for a number of years.

The fifth change is proposed for clarification and uniformity of all wholly-owned Government corporations with respect to administrative expense limitations.

The sixth change proposes the deletion of language for the sole purpose of shortening the wording of the item, and does not affect the authority of the Corporation set forth in 12 U.S.C. 1016-1020h.

ITEMIZATION OF AUTHORIZATION REQUEST

Fund: Administrative expenses

Classification	: Estimate, : : 1947 :	Estimate, : 1948 :	: Increase (+) or : decrease (-)
Payments for services received:	:	:	:
Farm Credit Administration ..	\$560,472:	\$421,302:	-\$139,170
Federal land banks .....	3,962,000:	2,793,000:	-1,169,000
Federal Reserve banks .....	6,000:	5,000:	-1,000
Treasury of the United States:	21,160:	15,000:	-6,160
General (miscellaneous) .....	368:	698:	+330
Grand total obligations ...	4,550,000:	3,235,000:	-1,315,000
Excess of obligations over	:	:	:
authorization due to exten-	:	:	:
sion of loaning authority	:	:	:
(Public Law 505) .....	-800,000:	- -:	:
Total authorization or	:	:	:
estimate .....	3,750,000:	3,235,000:	:







## FEDERAL INTERMEDIATE CREDIT BANKS

(Budgets, 12 individual banks--consolidated)

### Creation and Purpose

The 12 Federal intermediate credit banks were established pursuant to the Agricultural Credits Act, approved March 4, 1923 (12 U.S.C. 1021, 1022). Each bank operates under a District Farm Credit Board, which is ex officio, the board of directors of the Federal intermediate credit bank, Federal land bank, production credit corporation, and bank for cooperatives of the district. Three members of each board are elected and one is nominated by cooperative associations and borrowers from these institutions, and three are appointed by the Governor of the Farm Credit Administration.

### Capital Structure

Each of the 12 banks has a paid-in capital of \$5,000,000, a total of \$60,000,000 for the system, as provided in the Agricultural Credits Act of 1923. In addition, the United States Treasury holds in a revolving fund the sum of \$40,000,000, authorized by an Act of Congress approved January 31, 1934, out of which the Governor, with the approval of the Secretary of the Treasury, is authorized to subscribe and pay for additional capital stock or paid-in surplus of any Federal intermediate credit bank in accordance with the credit needs of eligible borrowers from such bank. This sum was paid to the banks in 1934, but was returned to the revolving fund in the fiscal year 1941, to be held available until further need therefor arises.

### Current Appropriations

No appropriations of funds are required, since the banks finance their lending activities through sales of their debentures and other borrowings, and pay their interest costs and other operating expenses out of income. Their budget programs, including estimates of their administrative expenses, are required to be submitted to the Congress for review pursuant to section 104 of the Government Corporation Control Act, approved December 6, 1945.

The principal income of the Federal intermediate credit banks is derived from interest and discount on their loans and discounts and income from investments in United States Government obligations. Their principal costs consist of interest on outstanding debentures and other borrowings, together with administrative expenses, which include assessments for supervision and examination by the Farm Credit Administration, as well as direct operating costs of the banks. Net loan and discount income from organization to June 30, 1946, after all costs and expenses were paid or provided for and all losses were absorbed, amounted to \$11,482,311. Net income from all sources amounted to \$39,334,872, out of which the banks have paid franchise taxes to the United States aggregating \$6,958,555, and accumulated earned surplus and reserves for contingencies aggregating \$32,376,317.

### Debentures and Borrowing Authority

The banks finance their lending activities principally through the issuance and sale to the investing public of consolidated collateral trust debentures and by direct borrowing from commercial banks (12 U.S.C. 1041 et seq.), rather than through the use of appropriated funds. Short-term loans from commercial banks are utilized when unexpected demands arise between monthly debenture sale dates. The banks are authorized also to rediscount eligible paper with the Federal reserve banks and to borrow from or rediscount with the Reconstruction Finance Corporation. It has not been necessary to use these facilities for a number of years. Debentures are required to be secured by the assignment and deposit with Farm Loan Registrars of cash, notes and other obligations representing loans and discounts, and United States Government obligations, at least equal in amount to the amount of debentures outstanding. The United States Government assumes no liability for the debentures or other obligations of the Federal intermediate credit banks, and that fact is required to be set forth on the face of their debentures (12 U.S.C. 1043).

Each Federal intermediate credit bank is authorized, with the approval of the Farm Credit Administration, to issue and sell collateral trust debentures and to borrow money. The amount of debentures which may be outstanding for the account of any bank may not exceed ten times its surplus and paid-in capital. No change in the borrowing authority of the banks is needed. Although they have authority to incur obligations up to ten times their capital and surplus, it does not appear that they would be able to obtain funds in the investment markets, upon terms which would enable them to extend credit to farmers and stockmen at reasonable rates of interest, if their total requirements should exceed substantially a ratio of \$4 of indebtedness to \$1 of net worth. The ratio of debt to net worth on June 30, 1946, was 3.37 to 1. On the basis of the anticipated volume of business for the fiscal year 1948, that ratio is expected to approximate 4 to 1 by June 30, 1948.

### Lending Operations

The Federal intermediate credit banks are agricultural banks of discount and do not make loans directly to individuals. They discount agricultural and livestock paper for and make loans to financing institutions and farmers' cooperative associations to finance the seasonal production and marketing needs of farmers and stockmen. Maturities of loans and discounts may not exceed 3 years. Eligible borrowing and rediscounting institutions include production credit associations, national and State banks, agricultural credit corporations and livestock loan companies. The banks are authorized also to make certain classes of loans and advances directly to cooperative marketing and purchasing associations. Since the passage of the Farm Credit Act of 1935, however, such loans ordinarily are made by the banks for cooperatives, which rediscount their larger commodity loans with the intermediate credit banks.

Being banks of discount, the Federal intermediate credit banks do not initiate lending programs or promote and develop a demand for their services. It is their function, expressly authorized and clearly defined in the Act, to finance eligible and acceptable paper in whatever volume may be offered by institutions qualified to receive credit from the banks. Their volume of business thus is governed by the demand for credit, which is affected by general economic conditions, prices of agricultural commodities, crop and livestock yields, and other variable factors, rather than by administrative action.

#### Examinations

Each Federal intermediate credit bank is required by law to be audited and examined at least once each year by Farm Credit Examiners, who are public officials having duties and responsibilities similar to those of National Bank Examiners. Beginning with the fiscal year 1945, these banks are also subject to annual audits by the General Accounting Office.

#### Basis of Estimates

The 1948 estimates are based upon the assumption that there will be no sudden drastic change in the general level of agricultural and livestock production, as compared with recent years; and that there will be an active market at reasonable price levels for agricultural products generally although it is expected that the total income from such products may be less than in the 2 preceding years. Also, that there will be some increased demand for credit due to such factors as continued high production costs, the need for new farming equipment, and repairs and improvements to farm property, and to changes in types of farming in some areas.

#### Summary of Operations

A summary of operations, actual for the fiscal year 1946 and estimated for 1947 and 1948, which is set forth in greater detail in the printed budget, is given in the table which follows. A brief outline of selected data relating to the activities of the banks from 1923 through June 30, 1946, also is attached.



	Fiscal Year	Fiscal Year	Fiscal Year
	1946	1947	1948
	Actual	Estimated	Estimated
<u>Funds Applied</u>			
To make loans and discounts	\$909,298,726	\$961,574,100	\$1,007,341,700
To repayments on borrowings	427,235,000	577,094,000	673,348,000
Operating expense:			
Interest and other			
money costs .....	2,653,830	3,101,500	3,455,400
Other Operating			
expense <sup>1/</sup> .....	1,664,847	1,673,900	1,844,100
Premiums written off on			
securities purchased ..	185,459	-	-
To investments in U.S.			
Government securities ..	24,064,115	7,738,500	9,000,000
To acquired security or			
collateral (net) .....	3	-	-
Franchise tax payable ...	288,018	231,600	188,600
To increase working			
capital .....	412,218	7,339,400	1,640,900
	<u>1,365,802,216</u>	<u>1,558,753,000</u>	<u>1,696,818,700</u>
<u>Funds Provided</u>			
By repayments on			
principal of loans and			
discounts .....	877,273,257	922,926,900	985,845,800
By borrowings .....	465,155,000	622,083,000	695,576,000
Operating income .....	5,486,676	5,975,600	6,392,800
Nonoperating income .....	26,145	28,900	4,100
By sale of investments in			
U.S. Government			
securities .....	17,860,447	7,738,500	9,000,000
Net decrease in other			
assets .....	691	100	-
	<u>1,365,802,216</u>	<u>1,558,753,000</u>	<u>1,696,818,700</u>

<sup>1/</sup> Includes compensation for services by banks for cooperatives: 1946 - \$84,261; 1947 - \$38,900; 1948 - \$89,100.

Selected data 1923 through June 30, 1946

1. Net return on average paid-in capital and paid-in surplus of \$57,518,489 for the 22-1/2 year period January 1, 1924, through June 30, 1946, equals 3 percent per annum after payment of interest and all operating expenses, and writing off all losses incurred.
2. Financial statement of June 30, 1946, shows: Paid-in capital, \$60,000,000. Investment in U. S. Treasury obligations of \$43,150,800 and cash \$11,705,475, total \$54,856,275. Surplus and reserves, \$32,376,317; total net worth, \$92,376,317. Debentures outstanding, \$306,630,000. Ratio of indebtedness to net worth was about 3.37 to 1.
3. In 1934 additional capital funds were provided through a revolving fund of \$40,000,000. This sum was paid in during 1934 but returned to the revolving fund in the fiscal year 1941, to be held available for additional capital payments when needed to enable the banks to render an adequate credit service to agriculture.
4. Current examinations of banks show capital and surplus intact - adequate provision for contingencies and reserves for doubtful assets.
5. No appropriation from the Treasury is made for expenses of the banks nor for the cost of their supervision, which now is assessed against and paid by the banks. Banks operate on self-supporting basis. Banks pay to Government annually franchise tax in cash representing 25 percent of net earnings after provision for all expenses, reserves, etc. Total franchise taxes paid since organization, \$6,958,555.
6. Banks obtain their loan funds principally by public sales of consolidated debentures, which are offered monthly in the open market to the investing public. They are not guaranteed by the Government as to either principal or interest. No default has ever occurred in meeting these obligations at maturity.
7. Credit extended in the year ended June 30, 1946, \$909,298,726. Credit extended since organization, \$9,618,453,784.
8. Losses sustained from organization in 1923 through June 30, 1946, amount to 9/100 of 1 percent of credit extended.
9. Expenses for year ended June 30, 1946, were \$1,373,813 (exclusive of assessments for supervision by Farm Credit Administration), compared with peak expenses of \$2,257,861 for 1934, a reduction of 39 percent.
10. In the fiscal year 1946 the banks had an average of 291 employees and extended \$909,298,726 of credit (an average of nearly \$3,125,000 per person), compared with 1934 when the number of employees reached a peak of approximately 1000 persons and volume of business handled amounted to \$405,885,559 (about \$406,000 per person).

11. Interest rates, which are related to the rates at which the banks sell their debentures in the investment markets, have fluctuated between a high of 6 percent in 1929 to the present rate of 1-1/2 percent, which has been in effect since February 24, 1939.

Administrative Expenses

Authorization, 1947 .....	\$1,500,000
Anticipated supplemental for additional costs in accordance with Public Law 521 .....	85,000
Total estimated expenses, 1947 .....	<u>1,585,000</u>
Budget estimate, 1948 .....	<u>1,755,000</u>
Increase, 1948 .....	<u>+170,000</u>

The increase of \$170,000 in this item for 1948 is composed of:

- (a) An increase of \$66,868 in cost of personal services. The banks have budgeted 298 average annual positions for the fiscal year 1948 representing an increase of 25.1 positions and \$66,868. The manpower contemplated for the fiscal year 1948 is the same as the actual utilized in the operation of the banks in the fiscal year 1945 when the system was on a 48-hour work week basis. It is the considered judgment of the officers of the banks, generally, that while they will be able to carry the workload during 1947 with their reduced manpower, and operate within the budget limitation, a continuation at the 1947 level over a longer period will inevitably impair their service and expose them to losses which otherwise might be avoided. During the war period agriculture enjoyed phenomenal yields, increasing price levels, and an almost unlimited demand and many credit factors which under ordinary conditions would have had an important bearing upon a borrower's debt-paying capacity could be largely discounted. The relatively prosperous position of agriculture continued through the fiscal year 1946 and, speaking generally, the situation in 1947 is favorable. The banks feel that the time is approaching when some reversal of the present favorable trend may be expected. Therefore, it is essential for the banks in the fiscal year 1948 to expand their program of working out the weaker loans and of examining even more carefully new offerings in order to prevent possible future losses to the banks and the corporations and associations utilizing the facilities of the banks. To accomplish the foregoing and to spend sufficient time in the field to keep abreast of developments in the agricultural areas and to advise with those who make the loans in the first instance will, it is believed, require the additional man-years budgeted for the 1948 fiscal year.
- (b) An increase of \$9,150 in cost of travel. This increase over the 1947 estimate is needed to permit the banks to resume more comprehensive servicing of their outstanding loans and discounts and to provide for other essential field work which was eliminated or deferred during the war period, when only trips of an emergency nature or trips involving urgent cases were made.
- (c) An increase of \$5,000 to provide in the estimates for payments into the Treasury for costs of handling penalty mail in 1948 in accordance with Section 2, Public Law 394, 78th Congress. The estimate is based on the cost rate established by the Post Office Department of \$18.60 per thousand pieces of mail.



- (d) An increase of \$35,200 in equipment expense. This increase over the amount estimated for 1947 reflects an accumulation of needed replacements which were deferred during the war emergency and further deferred in 1947. Equipment expense budgeted includes provision for replacement of 10 passenger-carrying automobiles at a net cost of \$10,000. All of the cars to be replaced will be more than 6 years old and have now reached the point where upkeep and maintenance costs are excessive.
- (e) An increase of \$21,169 in supervisory and examination assessment by the Farm Credit Administration. The net increase in the supervisory and examination assessment by the Farm Credit Administration is due to the annual revision in the cost-sharing ratio for distributing the assessable costs of the service divisions of the Farm Credit Administration among the contributing banks and corporations, and the adjustments necessitated by the transfer of the Emergency Crop and Feed Loan Division from the Farm Credit Administration.
- (f) An increase of \$32,613 in other objects of expense. The increased costs of the other items in the administrative expense budget consist of an increase of \$14,150 in the amounts to be assessed to the banks for the expense of the general agents' offices and an increase of \$18,463 in miscellaneous items necessary to meet increased costs and to make certain deferred purchases.

Language relating to administrative expenses

The estimates include proposed changes in the language of this item as follows (new language underscored, deleted matter enclosed with brackets):

Change  
No.

- 1 [Provided, That not] Not to exceed [\$1,500,000] \$1,755,000 (to be  
2 computed on an accrual basis) of the funds of the banks shall be  
3 available for administrative expenses, including the purchase of  
4 not to exceed ten passenger motor vehicles, services performed  
for the banks by other Government agencies (except services  
performed by the banks for cooperatives in connection with loans  
to cooperative associations rediscounted or pledged with the  
Federal Intermediate Credit Banks, and services performed by any  
Federal Reserve bank and by the U. S. Treasury in connection with  
5 the financial transactions of the banks), and not to exceed \$5,000  
6 for penalty mail; and said total sum shall be exclusive of interest  
expense, legal and special services performed on a contract or fee  
basis, and expenses in connection with the acquisition, operation,  
maintenance, improvement, protection, or disposition of real or  
personal property belonging to the banks or in which they have an  
interest.

The first change is proposed for the sole purpose of shortening and simplifying the wording of the item and will not affect the present authority in any manner.



The second change specifically authorizes administrative expenses, on an accrual basis as contemplated by the Government Corporations Control Act (59 Stat. 597), and payment thereof from funds of the banks. This practice, generally, has been followed for a number of years.

The third change authorizes the purchase of not to exceed ten passenger motor vehicles.

The fourth change specifically excludes from the limitation the cost of services performed by the banks for cooperatives in connection with loans to cooperative associations rediscounted or pledged with the Federal intermediate credit banks, and services performed by any Federal Reserve bank and by the U. S. Treasury in connection with the financial transactions of the banks since these costs are considered as a part of the cost of the banks financial operations rather than an element of administrative expense.

The fifth change sets a limitation on the use of penalty mail by the banks and authorizes the expenditure of bank funds for such service.

The sixth change is proposed for general clarification and uniformity of all wholly owned Government corporations with respect to administrative expense limitations.

#### ITEMIZATION OF AUTHORIZATION REQUEST

Fund: Administrative Expenses

Standard Classification	Estimate, 1947	Estimate, 1948	Increase (+) or decrease (-)
Personal services .....	\$1,009,323	\$1,076,191	+\$66,868
Directors' expense .....	25,100	26,900	+1,800
Travel expense .....	20,000	29,150	+9,150
Rent and utility services .....	97,300	101,800	+4,500
Communications .....	11,050	12,500	+1,450
Penalty mail .....	- -	5,000	+5,000
Printing, binding, and office supplies .....	16,400	21,300	+4,900
Equipment expense .....	8,300	43,500	+35,200
General agents' expense .....	100,850	115,000	+14,150
Insurance and fidelity bond premiums .....	5,000	9,100	+4,100
Miscellaneous .....	16,560	18,273	+1,713
Subtotal .....	1,309,883	1,458,714	+148,831
Payments for services received:			
Farm Credit Administration:			
Supervisory expense .....	232,837	254,906	+22,069
Examination expense - bank .....	41,380	41,380	- -
Examination expense - other .....	900	- -	-900
Grand total obligations .....	1,585,000	1,755,000	+170,000
Excess of obligations over authoriza-			
tion due to Public Law 521 .....	-85,000	- -	
Total authorization or estimate ..	1,500,000	1,755,000	

# Passenger-Carrying Vehicles

The estimate includes provision for the purchase of ten passenger-carrying vehicles at a net cost of \$10,000 after crediting the trade-in values of ten old vehicles which are to be exchanged. The continued use of three old vehicles is contemplated. The automobiles owned are badly worn and therefore, both inefficient in operation and costly to maintain, all being over six years old and the present estimated replacement expense represents an accumulation of needed purchases deferred during the war emergency and further deferred in 1947. The automobiles owned by the banks are used by officers and employees of the banks for necessary travel in connection with the making of new loans and discounts, and the servicing of outstanding loans and discounts, principally for travel between points which cannot be reached advantageously or economically by common carrier.

With respect to the cost of hire of motor vehicles, the furnishing of passenger motor vehicles by an agency under Farm Credit Administration supervision for use by Federal intermediate credit banks at a mileage rate estimated to cover cost of maintenance and operation, including depreciation, has not been treated as being under the requirements of Section 16, Act of August 2, 1946 (Public Law 600) and provision therefor has not been made in the budget estimate. Such use is infrequent and involves negligible expenditures.

There follow selected comparative data on the operations of the Federal intermediate credit banks:

## Federal Intermediate Credit Banks Selected Comparative Data

Item	June 30, 1944	June 30, 1945	June 30, 1946
Loans and discounts			
outstanding .....	\$321,025,910:	\$315,829,586:	\$347,856,705
Loans and discounts made			
during year ended .....	948,333,052:	873,643,868:	909,298,726
Debentures outstanding ...	285,040,000:	265,475,000:	306,630,000
Debentures issued during			
year .....	439,055,000:	395,750,000:	423,565,000
Franchise tax .....	a/ 231,011:	b/ 305,797:	c/ 288,018
Capital stock (owned by			
U. S. Government) .....	60,000,000:	60,000,000:	60,000,000
Earned surplus .....	21,504,874:	22,422,264:	23,286,318
Reserve for contingencies	8,325,000:	8,775,000:	9,090,000

a/ Represents tax for the fiscal year ended June 30, 1944, paid in July 1944.

b/ Represents tax for the fiscal year ended June 30, 1945, paid in July 1945.

c/ Represents tax for the fiscal year ended June 30, 1946, paid in July 1946.

## PRODUCTION CREDIT CORPORATIONS

(Consolidated budget for the 12 individual corporations)

### Creation and Purpose

The 12 production credit corporations were established pursuant to the Farm Credit Act of 1933, approved June 16, 1933 (12 U.S.C. 1131-1131c), to organize, partially capitalize, and supervise local production credit associations which were established to provide for the production credit requirements of farmers and stockmen. There were 505 active associations on June 30, 1946. Loans are made by the associations and their affairs are administered under the direction of their respective boards of directors, consisting generally of 5 members, under the supervision of the production credit corporations and the Farm Credit Administration.

### Type of Operations

The activities of the corporations consist principally of organization, training, and supervision and do not include the making of loans. The statements in this budget setting forth results of operations and financial positions and activities, actual and forecast, reflect principally the use of Government capital in connection with the purchase of association stock and investments in Government securities, and income and administrative expenses.

### Basis of Estimates

The 1948 estimates are based on the assumption that there will be no sudden drastic change in the general level of agricultural and livestock production, as compared with recent years; and there will be an active market at reasonable price levels for agricultural products generally although it is expected that the net income from such products may be less than the two preceding years. Further, it is expected that there will be an increased demand for credit due to continued high production costs, the need for new farming equipment, repairs and improvements to farm property. Accordingly, it is expected the production credit associations will extend credit to a larger number of farmers and that the extension of credit will require closer attention. As a result, the need for personnel training and supervision will continue, particularly in view of the substantial numbers of relatively new employees of production credit associations resulting from the high rate of turnover in recent years. It is expected that the investment of farmers in the capital stock of their production credit associations and the reserves of the associations will further increase and that the associations will retire additional class A stock owned by the production credit corporations.

### Retirement of Stock - PCA's and PCC's

Because of the anticipated continued improvement in the financial condition of the production credit associations through 1948, it is estimated that associations will retire class A stock owned by the corporation in



an amount sufficient to enable the corporations to reduce their capital stock owned by the Government from \$95,950,000 to \$91,150,000 and thereby return \$4,800,000 to the Treasury of the United States.

### Summary of Operations

A summary of actual operations for the fiscal year 1946 and estimates for 1947 and 1948, which is set forth in greater detail in the printed budget, is given in the following table:

	Fiscal Year:	Fiscal Year:	Fiscal Year:
	1946	1947	1948
	Actual	Estimated	Estimated
<u>Funds Applied</u>			
To investments in U.S. Government securities .....	\$58,947,300:	\$8,461,000:	\$7,781,000
Operating expense .....	1,558,683:	1,650,000:	1,702,000
Nonoperating expense (principally premiums written off on securities purchased) .....	690,941:	97,500:	95,700
To repayment of capital to U.S. Treasury .....	7,050,000:	5,300,000:	4,800,000
To increase (or decrease*) working capital .....	3,163:	*25,000:	*108,100
	<u>68,250,087:</u>	<u>15,483,500:</u>	<u>14,270,600</u>
<u>Funds Provided</u>			
By retirement of class A stock investment in production credit associations (net) .....	7,779,570:	5,247,500:	4,626,000
By sale of investments in U.S. Government securities .....	58,703,883:	8,429,200:	7,852,300
Operating income .....	1,746,716:	1,790,700:	1,792,300
Nonoperating income .....	19,418:	16,100:	- -
Net decrease in other assets .....	500:	- -	- -
	<u>68,250,087:</u>	<u>15,483,500:</u>	<u>14,270,600</u>

\* Deduct

The following table reflects (1) the trends toward increasing production credit association loan volume contrasted with decreasing personnel of the supervising production credit corporations; (2) increasing farmer-ownership of the production credit associations; and (3) some measure of the production credit corporations' supervisory responsibilities:

	December 31			
	1935	1941	1945	1946
No. of associations.....	555	530	511	504
No. of farmer stockholders.....	212,970	298,825	372,043	383,273
Amount of loans made, year ending.....	\$196,306,000	\$418,196,000	\$516,116,000	\$614,613,000
Capital stock owned by farmer stockholders....	\$8,410,000	\$19,852,000	\$32,973,000	\$38,076,000
Total accumulated earnings (reserves)....	\$2,954,000	\$22,027,000	\$34,922,000	\$38,650,000
Accumulated earnings plus farmer-owned capital stock as a percent of total net worth.....	12.9%	34.1%	55.1%	62.6%
PCC-owned capital stock....	\$76,803,000	\$81,044,000	\$55,355,000	\$45,898,000
No. of associations with \$50,000 or less PCC-owned capital stock....	(Not readily available)	0	72	126 <sup>1/</sup>
Percent of associations where income from membership sources during year exceeded expenses.....	25.0%	57.5%	82.4%	90.5%
<hr/>				
Total personnel of production credit corporations (average number of positions for year ending June 30).....	313	302	222	219

<sup>1/</sup> At January 1, 1947, the capital stock investment of the production credit corporations had been fully repaid by 12 of these production credit associations.

Administrative Expenses

Authorization, 1947 .....	\$1,600,000
Anticipated supplemental for additional costs in accordance with Public Law 521 1/ .....	50,000
Total estimated expenses, 1947 .....	1,650,000
Budget estimate, 1948 .....	1,702,000
Increase, 1948 .....	<u>52,000</u>

1/ The base pay increases granted by the several boards of directors, totaling \$70,581, averaged materially less than those provided for classified Government employees by the Federal Employees Pay Act of 1946. Of this total cost, \$20,581 is being absorbed within the current authorization.

The increase of \$52,000 for administrative expenses for 1948 is composed of:

(a) An increase of \$23,439 in supervisory assessment by the Farm Credit Administration.

The increase in the supervisory assessment by the Farm Credit Administration is due to a revision in the cost-sharing ratio for distributing the assessable costs of the service divisions of the Farm Credit Administration among the contributing banks and corporations, and is also due to adjustments necessitated by the transfer of the Emergency Crop and Feed Loan Division from the Farm Credit Administration.

(b) An increase of \$5,000 to provide in the estimates for payments into the Treasury for costs of handling penalty mail in 1948 in accordance with Section 2, Public Law 394, 78th Congress. The estimate is based on the cost rate established by the Post Office Department of \$18.60 per thousand pieces of mail.

(c) A net increase of \$18,306 in personal services consisting of (1) an increase of \$24,550 to cover a part of the cost of periodic promotions composed of \$570 for placing on a full-year basis in 1948 periodic promotions which are estimated to be in effect for only a part of the fiscal year 1947 and \$23,980 for periodic promotions estimated to occur in the fiscal year 1948 and (2) a decrease of \$6,244 in other personal services costs.

The decrease in personal services results from a reduction of 1.3 in the average number of annual positions in personnel requirements. The number of personnel of each corporation averages about 18; the field force, officers, and legal personnel averages about 12 per corporation, and the remaining 6 employees are largely secretarial. (Prior to the war the personnel averaged about 25 per corporation.)

(d) An increase of \$5,255 in other objects of expense.

The increase consists of an increase of \$4,600 in travel expense and a net increase of \$655 in miscellaneous items.



Travel in 1947 will be somewhat less than that necessary to provide for the most effective supervision of the associations. This is due to the fact that a substantial number of corporation-owned automobiles are beyond full-time service, and to inability to secure new cars during the first half of the year requiring travel by common carrier at greater cost. With the increase in loan volume in 1948 and probable narrowing margin of farm income, it is most important from the standpoint of effective supervision that the corporations be provided with adequate travel funds for the fiscal year 1948. The travel estimate averages about \$15,000 for each corporation or approximately 10 percent less than prewar.

The net increase of \$655 in miscellaneous items is necessary to meet increased costs and to make certain deferred purchases.

#### Language Relating to Administrative Expenses

The estimates include proposed changes in the language of this item as follows (new language underscored, deleted matter enclosed with brackets):

Change  
No.

- 1 [Provided, That not] Not to exceed [\$1,600,000] \$1,702,000
- 2 (to be computed on an accrual basis) of the funds of the
- 3 corporations shall be available for administrative expenses,
- 4 including the purchase of not to exceed twenty-four
- 5 passenger motor vehicles, services performed for the corpora-
- 6 tions by other Government agencies, and not to exceed \$5,000
- for penalty mail; and said total sum shall be exclusive of
- interest expense, legal and special services performed on a
- contract or fee basis, and expenses in connection with the
- acquisition, operation, maintenance, improvement, protection,
- or disposition of real or personal property belonging to the
- corporations or in which they have an interest.

The first change is proposed for the sole purpose of shortening and simplifying the wording of the item and will not affect the present authority in any manner.

The second change authorizes the accounting for administrative expenses on an accrual basis as contemplated by the Government Corporation Control Act (59 Stat. 597) and payment thereof from the funds of the corporations. This practice, generally, has been followed for a number of years.

The third change authorizes the purchase of not to exceed twenty-four passenger motor vehicles.

The fourth change authorizes reimbursement to other Government agencies for services performed for the corporations.

The fifth change sets a limitation on the use of penalty mail by the corporations and authorizes the expenditure of corporation funds for such service.

The sixth change is proposed for general clarification and uniformity of all wholly owned Government corporations with respect to administrative expense limitations.

# ITEMIZATION OF AUTHORIZATION REQUEST

Fund: Administrative Expenses

Standard Classification	Estimate, 1947	Estimate, 1948	Increase (+) or Decrease (-)
Personal services .....	\$982,963:	\$1,001,269:	\$+18,306
Directors' expense .....	27,700:	27,700:	- -
Travel expense .....	176,400:	181,000:	+4,600
Rent and utility services ..	49,800:	49,500:	-300
Communication services .....	16,500:	16,500:	- -
Penalty mail .....	- -	5,000:	+5,000
Printing, binding, and office supplies .....	17,000:	17,000:	- -
Equipment .....	18,000:	18,650:	+650
General agent's expense ....	96,800:	96,800:	- -
Insurance and fidelity bond premiums .....	6,900:	6,900:	- -
Taxes .....	1,500:	1,850:	+350
Miscellaneous .....	9,859:	9,814:	-45
Subtotal .....	1,403,422:	1,431,983:	+28,561
Payments for services re- ceived:			
Farm Credit Administration:			
Supervisory expense ....	238,838:	262,277:	+23,439
Examination expense ....	7,740:	7,740:	- -
Grant total obligations .....	1,650,000:	1,702,000:	+52,000
Excess of obligations over authorization due to Public Law 521 .....	-50,000:	- -	
Total authorization or estimate .....	1,600,000:	1,702,000:	



### Passenger-Carrying Vehicles

The estimate includes provision for the purchase of 24 passenger-carrying vehicles at a net cost of \$14,100 after crediting the trade-in values of 24 old vehicles which are to be exchanged. A substantial number of the automobiles owned by the 12 corporations are of questionable full-time serviceability due to their high mileage. The continued use of 45 old vehicles is contemplated. The automobiles to be exchanged are badly worn and, therefore, both inefficient in operation and costly to maintain. All of the vehicles to be exchanged are more than 6 years old and their replacement has been deferred during the war emergency and further deferred in 1947. The automobiles owned by the corporations are used by officers and field employees of the corporations for necessary travel in connection with the supervisory responsibilities of the corporations over the production credit associations; principally for travel to association offices and as required to the farms of association directors, applicants for loans, and borrowers.

With respect to the cost of hire of motor vehicles, the furnishing of passenger motor vehicles by an agency under Farm Credit Administration supervision for use by production credit corporations at a mileage rate estimated to cover cost of maintenance and operation, including depreciation, has not been treated as being under the requirements of Section 16, Act of August 2, 1946 (Public Law 600) and provision therefor has not been made in budget estimate.



REGIONAL AGRICULTURAL CREDIT CORPORATION  
OF WASHINGTON, D. C.

Creation and Purpose

Twelve regional agricultural credit corporations were established pursuant to the provisions of Section 201(e) of the Emergency Relief and Construction Act of 1932, approved July 21, 1932 (47 Stat. 713; 12 U.S.C. 1148), with authority to make loans to farmers and stockmen for agricultural purposes. Through a series of consolidations only one corporation, the Regional Agricultural Credit Corporation of Washington, D. C., remains.

Type of Operation

The Corporation is authorized to make loans and advances to farmers and stockmen, the proceeds of which are to be used for agricultural purposes (including crop production) or for the raising, breeding, fattening, or marketing of livestock (12 U.S.C. 1148). The Department of Agriculture Appropriation Act of 1944 (57 Stat. 428) restricted the operations of the Corporation by terminating its active lending operations under the Secretary of Agriculture's food production program after June 30, 1943, except for commitments already outstanding and further loans and advances to aid in the collection of outstanding loans and advances. This act and similar acts for subsequent years permit the Secretary to authorize and direct the Corporation to make loans to finance the production of specified crops and livestock in certain regions in various States designated as regions in which such loans are necessary in order to finance the production of crops or livestock that otherwise would not be produced.

The Corporation is authorized to rediscount eligible paper with the Reconstruction Finance Corporation, Federal Reserve banks, and the Federal intermediate credit banks (12 U.S.C. 1148). The Corporation is also authorized to borrow (other than by way of discount) from the Reconstruction Finance Corporation or any Federal intermediate credit bank (12 U.S.C. 1148b). The Corporation has not recently utilized this authority, and except for unforeseen emergencies, does not contemplate a need for borrowing funds during the fiscal year 1948.

Basis of Estimates

In appraising the budgetary requirements of the Corporation for the fiscal year 1948 it is assumed the Corporation will continue to engage in two distinct phases of lending operations; (1) the making of loans or advances in restricted areas which the Secretary of Agriculture shall have designated as regions in which the making of loans or advances is necessary; and (2) the orderly liquidation of outstanding loans and advances, including those made under the food production program of 1943 and the Wenatchee fruit loans. Also it is assumed that agricultural conditions will not change substantially.

Summary of Operations

A summary of operations, actual for the fiscal year 1946 and estimated for 1947 and 1948 which is set forth in greater detail in the printed budget, is given in the following table:

	Fiscal Year	Fiscal Year	Fiscal Year
	1946	1947	1948
	Actual	Estimated	Estimated
<u>Funds Applied</u>			
To make loans to farmers.....	\$6,018,209	\$1,500,000	\$1,650,000
Operating expenses.....	544,365	341,500	300,200
To acquisition and improve- ment of acquired security :			
or collateral.....	128,440	75,000	35,000
To investment in U. S. Govern- ment securities (special :			
reserve fund, fruit loans):	350,023	191,000	--
To increase (or decrease*) :			
working capital.....	5,054,387	834,673	* 284,900
	<u>12,095,424</u>	<u>2,942,173</u>	<u>1,700,300</u>
<u>Funds Provided</u>			
By repayments of principal of: loans and advances.....	10,621,667	1,901,000	1,584,000
By operating income.....	427,430	93,400	73,300
By nonoperating income; Re- coveries on assets charged:			
off, expense credits, and :			
prior year adjustments....	83,288	25,000	15,000
By sale of acquired security: or collateral.....	66,269	43,000	28,000
By capital and surplus sub- scription U.S. Treasury :			
(through Reconstruction :			
Finance Corporation).....	550,000	332,000	--
By sale of investments in :			
U.S. Government securit- :			
ies (special reserve fund, :			
fruit loans).....	326,020	541,023	--
Net decrease in other assets:	20,750	6,750	--
	<u>12,095,424</u>	<u>2,942,173</u>	<u>1,700,300</u>



Administrative Expenses

Authorization, 1947 .....	\$341,000
Budget estimate, 1948.....	<u>300,000</u>
Decrease, 1948.....	<u>-41,000</u>

The net decrease of \$41,000 for 1948 consists of:

- (a) A net reduction of \$20,583 in personal services and miscellaneous objects of expenses. This reduction includes a decrease of 6.3 average annual positions and \$21,415 in personal services to give effect to the discontinuance of the active lending operations of the Wenatchee branch and a reduction of personnel in that office to the minimum number required to distribute the special and contributed reserve funds and to otherwise terminate the affairs of that office as well as to the closing of the St. Paul office heretofore maintained to facilitate the servicing of loans charged off by the Regional Agricultural Credit Corporation of Washington, D. C. The shift of the loan servicing function from emergency crop and feed loan field staff will necessitate the employment of a limited number of field men on a W. A. E. basis to assist the district vice presidents to discharge their responsibilities with respect to loan servicing. Eight average annual positions have been provided for this function.

This net reduction also includes an increase of \$832 in miscellaneous objects of expense. While it is estimated that \$4168 less will be expended for such expense during the fiscal year 1948 than during the fiscal year 1947, an increase of \$832 is reflected due to the contemplated sale of equipment during the fiscal year 1947 in the approximate amount of \$5000 and the credit of this amount to equipment expense. A part of such equipment represents automobiles which have become surplus due to the proposed curtailment of the Wenatchee operation.

- (b) An increase of \$4,000 to provide in the estimates for payments into the Treasury for costs of handling penalty mail in 1948 in accordance with Section 2, Public Law 394, 78th Congress. The estimate is based on the cost rate established by the Post Office Department of \$18.60 per thousand pieces of mail.
- (c) A reduction of \$24,417 in payments for services rendered the Corporation. The direct cost of the accounting and fiscal services rendered by the central office of the Farm Credit Administration and its examination service is reflected in Schedule B-1 of the printed budget under Farm Credit Administration central office facilities and examination expense for the fiscal years 1946 and 1947. No part of the cost of general Farm Credit supervision is assessed against the corporation through the 1947 fiscal year; however, under the proposed authorizing language for 1948, all such expenses will be paid from corporate funds and they are, therefore, included in the budget for 1948.

In the Berkeley district, the making of restricted area loans, and the servicing, accounting for, and the collection of both food production and restricted area loans are handled by the Federal intermediate credit bank and selected production credit associations. The cost of this service, together with the cost of services rendered by the general agents' staff in the Berkeley district and several of the other farm credit districts, is reflected on Schedule B-1 of the printed budget under Payments for Services Received - District agencies.

During the fiscal year 1946 and a part of the fiscal year 1947, the emergency crop and food loan offices in all districts, with the exception of the Berkeley district, continued to service, account for and collect food production loans. Also the emergency crop and feed loan regional offices, except in the Berkeley district, made and serviced all restricted area loans. Effective September 1, 1946, the accounting and fiscal functions heretofore performed by the emergency crop and feed loan regional offices were recentralized in the Washington office and it is expected that the regional offices will be relieved of loan servicing functions at the close of the 1946 fall collection season. The services of an occasional loan clerk in the county war board offices were utilized during the fiscal year 1946, however, all such services were discontinued by the end of the fiscal year. Forecasts as to the cost of payments for services received have been based on prior years' experience adjusted in the light of corporation activity forecast for the fiscal years 1947 and 1948.

Language relating to administrative expenses

The estimates include proposed changes in the language of this item as follows (new language underscored, deleted matter enclosed with brackets):

Change

No.

- 1, 2 [Provided, That not] Not to exceed [\$341,000] \$300,000 (to be  
computed on an accrual basis) of the funds of the Corporation
- 3 shall be available for administrative expenses, including  
supervision and examination by the Farm Credit Administration  
and services performed for the Corporation by other Govern-
- 4 ment agencies, and not to exceed \$4,000 for penalty mail;
- 5 and said total sum shall be exclusive of interest expense, legal  
and special services performed on a contract or fee basis, and  
expenses in connection with the acquisition, operation, main-  
tenance, improvement, protection, or disposition of real or  
personal property belonging to the Corporation or in which it
- 6 has an interest: Provided, That no other funds shall be avail-  
able for administrative expenses of the Corporation.

The first change is proposed for the sole purpose of shortening and simplifying the wording of the item and will not affect the present authority in any manner.

The second change authorizes accounting for administrative expenses on an accrual basis as contemplated by the Government Corporation Control Act (59 Stat. 597) and payment thereof from the funds of the corporation. This practice, generally, has been followed for a number of years.

The third change authorizes reimbursement to the Farm Credit Administration for supervision and examination and reimbursement to other Government agencies for services performed for the corporation.

The fourth change sets a limitation on the use of penalty mail by the corporation and authorizes the expenditure of corporation funds for such service.

The fifth change is proposed for general clarification and uniformity of all wholly owned Government corporations with respect to administrative expense limitations.

The sixth change provides that all administrative expenses, including the cost of supervision of the corporation by the Farm Credit Administration heretofore paid by the Reconstruction Finance Corporation (12 U.S.C. 1148), shall be paid from funds of the corporation.

#### ITEMIZATION OF AUTHORIZATION REQUEST

Fund: Administrative Expenses

Standard Classification	: Estimate, : : 1947	: Estimate, : : 1948	: Increase (+) or : Decrease (-)
Personal services.....	\$93,650	\$72,235	-21,415
Travel expense.....	18,000	17,000	-1,000
Rents and utility services.....	3,000	2,000	-1,000
Communications.....	1,500	1,200	-300
Penalty mail.....	- -	4,000	+4,000
Printing, binding and office supplies.....	460	492	+32
Equipment expense.....	-5,000	100	+5,100
Insurance and fidelity bond premiums.....	4,000	2,000	-2,000
Miscellaneous.....	5,000	5,000	- -
Subtotal.....	120,610	104,027	-16,583
Payments for services received:			
Farm Credit Administration:			
Central office facilities and examination expense....	32,390	67,273	+34,883
District agencies.....	58,000	128,700	+70,700
Other Government agencies....	130,000	- -	-130,000
Total authorization or estimate.....	341,000	300,000	-41,000



Passenger-Carrying Vehicles

The estimates do not include provision for the purchase of any passenger-carrying vehicles although the continued use of 2 old vehicles is contemplated. These 2 passenger cars are for the use of the acting branch manager and other officer personnel in the liquidation of the Wenatchee fruit loan program. With respect to the cost of hire of motor vehicles, the furnishing of passenger motor vehicles by an agency under Farm Credit Administration supervision for use by Regional Agricultural Credit Corporation of Washington, D. C. at a mileage rate estimated to cover cost of maintenance and operation, including depreciation, has not been treated as being under the requirements of Section 16, Act of August 2, 1946 (Public Law 600) and provision therefor has not been made in the budget estimate.

There follows a tabulation of selected data on the operations of the regional agricultural credit corporations:



REGIONAL AGRICULTURAL CREDIT CORPORATION OF WASHINGTON, D. C.

Loans Receivable  
Progress in Liquidation as of June 30, 1946

Restricted Area Loans:

Loans and advances (December 1943 through June 30, 1946).....	7,894,388	
Less: Repayments.....	7,092,305	
Charge-offs.....	15,277	7,107,582
Balance outstanding (9.97%).....		786,806

Food Production Loans and Advances:

Loans and advances (February 1943 through June 30, 1946).....	69,261,709	
Less: Repayments.....	62,628,112	
Charge-offs.....	590,403	
Cancellations.....	3,409,095	66,627,610
Balance outstanding (3.80%).....		2,634,099

Fruit Loans - Wenatchee Area:

Loans and advances (March 1941 through June 30, 1946).....	34,306,683	
Less: Repayments.....	33,947,014	
Balance outstanding (1.05%).....		359,669

Other Loans:

Loans and advances (October 1932 through June 30, 1946).....	550,102,196	
Less: Repayments.....	547,363,221	
Charge-offs.....	2,710,019	550,073,240
Balance outstanding (0.005%).....		28,956

Sales contracts, notes receivable, etc.....	30,366
Advances for borrowers.....	10,358

Total outstanding..... \$3,850,254

NOTE: Beginning of period shown in foregoing is beginning of the program.



FEDERAL SURPLUS COMMODITIES CORPORATION

As proposed in the 1947 Budget, the Board of Directors of the Federal Surplus Commodities Corporation resolved on December 18, 1946 to voluntarily dissolve the Corporation. Accordingly, the consent to dissolution has been filed with the State of Delaware.

The Corporation's accounts payable have been paid. Accounts receivable amounting to \$235.23 have either been referred to the General Accounting Office for collection or transferred to a memorandum asset account. The Corporation's cash in the amount of \$2,704,631.83 has been transferred to the general funds in the U. S. Treasury.

Thus, the financial affairs of the Federal Surplus Commodities Corporation have been liquidated and the Corporation has been legally dissolved. It should be noted, however, that the Corporation can be sued for three years after legal dissolution.





U. S. DEPARTMENT OF AGRICULTURE

EXPLANATORY STATEMENTS

o f

WORK UNDER APPROPRIATIONS

a n d

SUPPLEMENTAL FUNDS

Fiscal Year 1948

Volume I

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OFFICE OF THE SECRETARY

- (1) General administration: This item includes the immediate Offices of the Secretary, Under Secretary and Assistant Secretary, together with their respective staffs. These Offices are responsible, at the highest level, for the supervision and direction of the Department as a whole and for formulating and carrying out agricultural policies. The Secretary's immediate staff, consisting of the Under Secretary, Assistant Secretary and other aides, represents him in many direct dealings with the Congress, the heads of operating bureaus and agencies, and as liaison with other departments and independent establishments. They act for the Secretary in discharging responsibility for the Department's programs and other activities, and advise with him regarding organization and programs, and the economic significance of proposed policies and legislation.

American agriculture has undergone far-reaching changes as a result of the war. After actual fighting stopped, demands for food were even greater than before and our contributions to foreign needs, together with the continued high rate of food consumption at home, have necessitated continued production at wartime levels. Thus we still face the major difficult readjustments to a peacetime agricultural economy. Problems of major significance confronted in reconversion to a peacetime basis include the termination of wartime contracts; the removal of war-created subsidies; supporting the prices of farm products during the reconversion period, the disposal of war-created surpluses; the reestablishment of foreign trade; the restoration and conservation of soil, forest and water resources; and improvements in rural living standards. The Department's research activities, particularly in the fields of marketing and utilization will be greatly expanded under the Research and Marketing Services Act of 1946. These and many other problems, both administrative and program in nature, require the time and careful attention of the general administrative staff.

- (2) Personnel administration and service: The Office of Personnel, acting as a staff agency for the Secretary of Agriculture, has responsibility for the program of personnel management of the Department, which includes recruitment, placement, leave, separation, retirement, position classification, compensation, wage and salary administration, efficiency ratings, techniques of personnel organization and management, issuance of rules and regulations relating to personnel administration, interpretation of personnel legislation, Civil Service Commission regulations and other directives pertaining to personnel work, safety, counseling, employees grievances, health and first aid, collaboration with colleges and universities on matters pertaining to recruitment and training, training in office skills, supervision improvement, work improvement, and investigation of cases involving alleged misconduct or delinquencies

The Office operates through six functional Divisions: Organization and Personnel Management, Classification, Employment, Training, Personnel Relations and Safety, and Investigations. Each Division is responsible

to the Director for the efficient carrying out of the functions and responsibilities in its particular field of work.

This Office has Department-wide leadership, coordination and guidance in the field of personnel administration, placing much of the work in the Bureaus through delegations of authority. Inherent in this extended program of delegated authority is the necessity to periodically review field and bureau personnel offices. A sound, well-administered personnel office review program can be one of our greatest stimulants to improvement in personnel administration throughout the Department.

The ending of World War II brought to the Department many problems in connection with the restoration of returning veterans. The Department had 18,305 employees in the Military Service of which 10,535 have been restored to their former jobs, one of like pay, seniority and status, or, when possible, to higher grades. The provisions of veterans legislation were carefully studied and appropriate regulations issued. An agreement permitting the training of veterans on the job under Public Laws 16 and 346 has been in operation throughout the year, along with other training programs to insure effective re-orientation of the veterans. An advisory Committee on Re-employment of Veterans, representative of the several bureaus, has been constantly alert to needed adjustments in plans, policies and regulations.

The conversion to regular Civil Service methods of recruitment and employment involved close cooperation with the Civil Service Commission and the operating bureau personnel. Plans, policies and procedures have been studied and instructions are being issued to coordinate the new procedures with the temporary War Service Regulations so that as little operating efficiency as possible will be lost during the transition period.

The development and preparation of job specifications was considerably accelerated. Various salary and related acts were passed by the Congress necessitating increased emphasis on salary administration, standards of work performance, hours of work, night differentials and other related activities. The collection, compilation and analysis of wage data in reference to the Department's policy of paying prevailing rates for unallocated positions continues heavy as a result of reconversion conditions and adjustments.

With the passage of Public Law 658, 79th Congress, there is opportunity for the beginning of a full health program. This is essential to proper personnel utilization. The Program will be limited at the start and can be expanded as its effectiveness is demonstrated. Emergency rooms and first-aid facilities are maintained at some points where needs justify such facilities.

Through the Employee Safety Program, the Department continued its efforts to minimize the accidents and injuries suffered by its employees. Through the Departmental Safety Council a long-term program of safety work was



laid down. This Council is composed of representatives from each of the bureaus, bringing to focus the many hazardous working conditions of the entire Department where the safety engineers may study and recommend measures to be undertaken to decrease the accident frequency rate and eliminate, as nearly as possible, all accidents.

The Employee Relations and Services Program gave continued emphasis to the policy of the Department in rendering encouragement and aid to activities which contribute to broad personnel development and to satisfactory adjustment of the employee to his job and to those who direct his activities. That comparatively few grievance cases reach the Departmental level reflects credit upon those administering the program in establishing policies and procedures that minimize potential grievances reaching an acute stage. Knowledge of community facilities were made available to employees in connection with individual needs for housing, transportation, child day care, personal counseling and general recreational activities.

Management phases of a broad and practical nature were given special emphasis through training programs. The high rate of employee turnover during the fiscal year 1946, the return of discharged veterans and employees with civilian employee rights, combined with budgetary and personnel ceiling limitations, confronted the Department with a serious need for better management improvements, man-power utilization and training in order to fulfill its responsibilities. A material contribution was made to increase employee skills by giving special training. A Work Simplification Program was sponsored by the Office which improved the work of and efficiency at every level of organization. Bureau Training Councils were established to aid and facilitate the Training Program.

Investigations of alleged fiscal and other irregularities continued, but special investigations were kept to a very minimum. Pre-employment and other inquiries were conducted along with suitability investigations of employees occupying key positions in the Department.

The functions of organization review represent a safeguard against the duplication and overlapping of activities in the Department. The re-evaluation of program objectives in terms of peace-time needs, the termination of activities geared to wartime demands, and the readjustment of programs to the civilian and peacetime economy necessitated numerous adjustments in the organizational structure of the Department.

- (3) Budgetary and financial administration and service: The Office of Budget and Finance functions as a staff office for the Secretary in formulating policies, developing and promulgating procedures, effecting coordination, and maintaining general supervision over the budgetary and financial affairs of the Department, including the preparation, evaluation and revision of budget estimates; the acquisition, allotment and apportion-

ment of funds; the consolidation, review and analysis of financial and legislative aspects of budgetary and program proposals; analysis of manpower ceiling requirements; accounting, auditing, financial reporting activities; procurement management and supply utilization in connection with the purchase, sale, warehousing and related activities; reviews and recommends changes in the Department's regulations, etc., and, under delegation of authority from the Secretary, approves certain types of fiscal transactions such as apportionments and allotments of funds, authorizations, certifications, requisitions for disbursing funds, etc.; and other matters involved in the financial administration of the Department.

In cooperation with the other staff offices and with the program agencies, the Office develops means for effecting improvements, in the interest of economy and efficiency, in the management and operations of the Department's activities. The Office is called upon to make management surveys; devise and establish procedures which will facilitate the efficient and continuous flow of administrative and fiscal work; and develop standards of operation, unit costs, and performance; it participates in departmental efforts to secure conformity with established standards and policies; and formulates proposals for improvements in special areas of management control, each needing analysis and decision and requiring close collaboration with officials of the program agencies and other staff offices.

The Office of Budget and Finance serves as the central point of contact, represents the Department on budgetary, fiscal, procurement, warehousing, manpower ceilings and related matters with the Budget Bureau, the General Accounting Office, the Treasury Department, Congressional Committees on Appropriations and other agencies. In response to requests, it renders numerous reports and financial statements relating to the work and finances of the Department.

The Office advises and consults with all agencies of the Department in the development of reporting systems; the solution of accounting and financial reporting problems; the development of policies, standards and techniques in connection with both government and commercial type audits of the financial activities of the Department, and collaborates in the planning and developing of internal audit programs.

The Office also maintains summary accounting records of appropriations, trust, contributed, working, and other funds made available to the various agencies of the Department. In addition thereto it performs fiscal, accounting and related services for certain agencies in the Department.

The work is performed, under the supervision of the Director of Finance, through seven functional divisions as outlined below and a small staff of budget and fiscal examiners who maintain direct, day-to-day contact with the work of the principal operating, or program, agencies of the Department.

Division of Estimates and Allotments  
(which includes the following sections):

- a. Estimates
- b. Allotments and Apportionments
- c. Budgetary Reports and Statistics
- d. Legislative Reports and Service
- e. Special Projects

Division of Accounting (which includes  
the following sections):

- a. Fiscal Examining
- b. Departmental Accounts
- c. Bureau Accounting Service

Division of Fiscal Management

Division of Corporate Fiscal Service

Division of Audit

Division of Purchase, Sales and Traffic

Division of Procurement and Supply Management  
(which includes the following sections):

- a. Procurement Management
- b. Supply and Warehouse Management  
(which provides technical direction  
and guidance to seven Area Agri-  
cultural Equipment Committees).

- (4) General operations: As a staff agency of the Office of the Secretary, the Office of Plant and Operations is responsible for the planning, initiation, development, coordination and execution of the operational activities of the Department as they relate to departmental housing, records administration, communications services (including telephone and telegraph service and the handling of mail), technical advisory service where engineering principles are involved in the procurement, operation and maintenance of equipment, coordination of mapping operations; passenger transportation, central storeroom and supply photographic and duplicating, and motor transport services; and administrative service functions for the Office of the Secretary.

The Equipment and Engineering Services Division affords the bureaus and agencies of the Department technical advice on equipment and engineering problems. The Division is in constant contact with commercial and governmental interests with a view to keeping abreast of the advances being made during the reconversion period in the fields of automotive, farm machinery, heavy construction, laboratory, and other types of technical and scientific equipment. The



value of the engineering skills of this Division rests largely on the ability of the staff to comprehend these advances and apply their understanding to the processes which prevail in the Department in its acquisition, utilization and maintenance of equipment with which engineering principles are concerned.

The Real Estate Division is concerned with the housing of the nationwide activities of the Department. The Division furnishes leadership and advice to the bureaus and agencies of the Department in leasing and space-management matters, and maintains close liaison with the Federal Works Agency and Post Office Department on related matters. The Division is constantly alert to the possibilities for space economies and consolidation in the interest of more effective administration, as well as improved facilities designed to promote increased employee efficiency. During the past fiscal year, the Division effected a reorganization of space occupancy in buildings occupied by the Department of Agriculture in the District of Columbia. The reorganization had two objectives, first, to bring the affected agencies into closer and more economical operating pattern, and second, to provide approximately 100,000 square feet of space needed to house major portions of returning decentralized agencies. Both of these objectives were attained, and an estimated annual savings of approximately \$200,000 in rental costs was effected for the Government. This calculation is based on information from the Commissioner of Public Buildings that space comparable to the type provided in Federal Buildings rents for \$2.00 per square foot. Through better space layouts, elimination of excess equipment, records, etc., it was possible to provide the 100,000 square feet of space needed to house the Rural Electrification Administration in toto and approximately one-half of the Farm Credit Administration.

Pertinent problems now confronting the Department in the field include the termination of most of our leases because of the expiration of renewal options, marked advances in office rentals, and in many instances our inability to retain and acquire space at any price. The return of many professional people from the war and the upsurge of commercial activities has developed severe competition to the Federal Government in its need for space. No relief appears to be in sight until cities are able to build up to their normal needs for modern office construction.

An important problem presently engaging the attention of the Communications Division is that of management and disposition of departmental records. This problem presents one of the major service challenges to the Federal Government. The field of records administration is relatively new, but of tremendous importance. The installation of approved records administration and disposition practices in a single bureau represents a tremendous amount of work when one considers the accumulation of records over the years under diverse systems and scattered in many locations. The Division's records administration program, despite its limited staff, is making marked progress. During the past fiscal year there was developed a master disposition



schedule for many standard and related form records which have a tendency to accumulate rapidly. Through the adoption of this schedule, much paper work is eliminated and the disposition of obsolete records greatly facilitated.

The Technical Assistant in charge of mapping coordination and related activities for the Department has initiated and participated in the general adjustment of this program of work from wartime to peacetime operations. Programs have shifted from activities designed to further the prosecution of the war to the resumption of programs and projects which were necessarily curtailed or stopped during the period of hostilities. The mapping work of the Department is an integral part of the overall governmental program and the Department's activities are being geared with this general pattern as represented through the leadership of the representative of the Bureau of the Budget concerned with this work.

(b) Working Capital Fund, Department of Agriculture

The working capital fund is a "no-year" operating fund of \$400,000 established in the 1944 appropriation act to pay the operating costs of certain centralized service organizations pending the receipt of reimbursements for such costs from the serviced bureaus and agencies. The integrity of the original appropriation is maintained from year to year by means of these reimbursements, and an appropriation in 1948 is, therefore, unnecessary.

A separate schedule of expenditures and reimbursements and a statement of assets and liabilities of the working capital fund as of June 30, 1946, is printed in the Budget schedules and in the Subcommittee Print for the fiscal year 1948.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
<u>Emergency Fund for the President,</u>			
<u>National Defense (Allotment to</u>			
<u>Agriculture), Office of the</u>			
<u>Secretary of Agriculture:</u>			
1. For expenses of the President's			
Famine Emergency Committee, and			
to enable the United States to			
carry out its responsibilities			
with respect to food for relief			
abroad .....	\$27,851:	\$25,000:	- -
2. For expenses incident to carry-			
ing out the duties and responsi-			
bilities of the Office of			
Government Representative for			
Meat Supply .....	7,325:	- -:	- -
Total, Emergency Fund for the			
President, National Defense			
(Allotment to Agriculture),			
Office of the Secretary of			
Agriculture .....	35,176:	25,000:	
<u>Working Fund, Agriculture, Office of</u>			
<u>the Secretary:</u>			
Advance from War Department: For			
technical direction and			
coordination of mapping and			
charting work performed for War			
Department .....	3,000:	- -:	- -
<u>Supply and Distribution of Farm Labor:</u>			
For accounting services in connec-			
tion with Farm Labor program funds			
allotted to the Extension Service a/	12,628:	5,330:	- -
<u>Penalty Mail Costs, Department of</u>			
<u>Agriculture (Allotment to Office of</u>			
<u>the Secretary): For cost of</u>			
penalty mail pursuant to Section			
2, Public Law 364, 78th Congress	3,548:	3,025:	3,750
<u>TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL</u>			
<u>FUNDS .....</u>	54,352:	33,355:	3,750

a/ Allotment from funds appropriated on a calendar year basis for the farm labor supply program in a separate act. Availability of present funds appropriated for this program is limited to June 30, 1947.

PENALTY MAIL COSTS, DEPARTMENT OF AGRICULTURE  
(Section 2, Public Law 364, approved June 28, 1944)

Funds made available under this head cover the costs of penalty mail for the Department in accordance with the provisions of Section 2(c) of Public Law 364, approved June 28, 1944. This Act provides that each department, agency and establishment of the Government, except the Post Office, War and Navy Departments, beginning with the fiscal year 1945, shall include in its estimates of appropriations an amount representing the anticipated cost to the Post Office Department of handling the penalty mail of such department, agency, or establishment. Section 2(d) requires payments to be made into the general fund of the Treasury, from appropriations available for the purpose, an amount equivalent to the costs of handling such penalty mail. It is from this appropriation that such payments are made.





RESEARCH AND MARKETING ACT OF 1946

As the Budget Estimates for this item represent the first estimate for an appropriation for carrying out the purposes of the Research and Marketing Act of 1946, approved August 14, 1946 (Public Law 733), all information pertaining thereto is included in the Digest of Budget Estimates.

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OFFICE OF THE SOLICITOR

Objective: To advise the Secretary and other administrative officials on legal problems arising in connection with all phases of their duties, in accordance with a Congressional enactment in 1910 providing that "the legal work of the Department of Agriculture shall be performed under the supervision and direction of the Solicitor."

Necessity: The Department of Agriculture has been made responsible for carrying out the Nation's food program, as well as for the administration and enforcement of the statutes, regulatory and otherwise, which provide the basis for the major agricultural and food programs of the country, including production, distribution, conservation, credit, electrification, research, and others. Many and varied legal problems arise in the conduct of such activities, and for the solution of these problems it is necessary that administrative officers have legal advice and assistance involving the consideration and application of practically all branches of the law.

General Plan and Scope of Work: In order to maximize their usefulness, the office is organized into sixteen legal divisions and one administrative division, with ten regional offices in the continental United States and one regional office in Puerto Rico. The various divisions of the office serve and counsel corresponding administrative units of the Department.

The work of the Office consists, among other things, of the rendering of legal opinions relative to the application of statutes, executive orders, and administrative rules and regulations; the drafting, examining, and construing of contracts, deeds, mortgages, leases, and other legal documents, and the preparation of proposed administrative rules and regulations, orders, and proclamations.

The Office conducts administrative hearings in reparation, disciplinary and other types of regulatory proceedings and issues tentative findings, conclusions, and orders with respect thereto. At hearings held before the Secretary, the Solicitor's Office represents the Department as counsel, and handles contacts on legal matters with other Federal and State governmental agencies.

The Office of the Solicitor also prosecutes, for employees of the Department, applications for patents on inventions which are to be used in departmental work and considers and recommends the appropriate disposition of claims for damage both for and against the Department.

On the enforcement side, the Office examines evidence to determine whether there have been violations of acts and orders administered by the Department and, in proper cases, the Solicitor recommends prosecution to the Attorney General. Pleadings and briefs in civil and criminal cases involving these agencies and the laws administered by them are drafted by the Office, and the

office cooperates with the Department of Justice in handling such litigation in the lower and appellate courts.

Statement of Activities: A brief description of each functional project is given below, together with a resume of major activities.

General Administration and Business Functions

This project includes the supervision and direction, by the Solicitor and his immediate staff, of the performance of all legal work for the Department, both departmental and field; and all administrative and business functions of the Office of the Solicitor, both departmental and field, including personnel, budget, fiscal, procurement, and administrative services.

Agricultural Adjustment, Crop Insurance, and Labor Programs

Conservation and Adjustment Programs: Under this project is performed legal work incident to certain activities of the Federal Crop Insurance Corporation and the Field Service, Tobacco, Cotton, Grain, Fats and Oils, and Sugar Branches of the Production and Marketing Administration, as follows:

- (a) Compliance with food orders and regulations.
- (b) Agricultural conservation programs, range conservation programs, and naval stores conservation programs, on the continent and in the territories, and payments to eligible producers, under the Soil Conservation and Domestic Allotment Act, as amended.
- (c) Imposition and adjustment of marketing quotas, when the supply situation requires, under the Agricultural Adjustment Act of 1938, as amended.
- (d) Fees or limitations on certain imports in order to prevent interference with specified programs, under Section 22, Agricultural Adjustment Act (1933).
- (e) Payments to sugar beet and sugar cane producers, under the Sugar Act of 1937.
- (f) General crop insurance programs with respect to cotton, wheat, and flax, and experimental insurance programs on corn, tobacco, and such other crops as may be selected.
- (g) Liquidation activities with respect to wheat and cotton crop insurance on 1943 and prior crops.
- (h) Settlement and litigation activities with respect to marketing quotas on 1942 and prior crops of cotton and wheat and 1945 and prior crops of tobacco, agricultural conservation programs for 1946 and prior years, acreage adjustment payments under 1933-1935 AAA programs, and with respect to crop insurance on 1945 crops.



Legal work performed during the 1946 fiscal year has included (a) the preparation of orders, forms and procedures required for the continued control of the distribution of scarce farm materials and supplies, such as machinery, fertilizer, insecticides, lumber, copper wire and engines; preparation of the necessary regulations, forms and procedures for a program of soil and water conservation designed to assure the maximum production of crops, for marketing quota programs with respect to Burley, flue-cured, fire-cured, and dark air-cured tobacco to provide adequate supplies of these kinds of tobacco without interference with the production of other essential crops, and for crop insurance programs covering cotton, wheat, flax, corn, and tobacco; preparation of proclamations terminating marketing quotas for wheat, cotton, corn, peanuts, and rice; review of approximately 600 formal determinations by review committees relating to tobacco marketing quotas and the preparation of notices on behalf of the Secretary reopening cases for rehearing and redetermination; and (b) activities with respect to settlement and litigation, including (1) collections made directly as the result of demand letters and negotiations of penalties overdue under the marketing quota programs for wheat, cotton and tobacco; where court action was necessary to achieve collection, the collection and preparation of evidence and lists of witnesses, preparation of pleadings to be transmitted to the Department of Justice, frequently followed by preparation of law memoranda and briefs for use of United States Attorneys, and occasional active participation in court proceedings; preparation of defense of cases brought in State courts by producers seeking judicial review of administrative determinations of farm marketing quotas; (2) similar activities in connection with recovery of agricultural conservation program payments where such payments were made through error or as the result of false representations by payees or others concerned, and defense of claims to agricultural conservation program payments; (3) preparation of criminal cases arising in connection with the programs as the result of false representations, conspiracy, to defraud the United States, etc; (4) similar preparation of crop insurance cases for filing in the Federal courts and defense of crop insurance cases filed in State courts. Negotiation and litigation activities resulted in collection of \$352,469.44 in marketing quota penalties plus interest, \$93,618.75 in conservation program payments, and \$344.36 in crop insurance cases.

Stabilization and Labor Programs: Under this project is performed legal work necessary to certain activities of the Production and Marketing Administration, Office of Foreign Agricultural Relations, the Bureau of Agricultural Economics, the Federal Extension Service, and the several state Extension Services.

Legal work in connection with the stabilization of wages and

salaries of agricultural labor has included the preparation of regulations in the wage stabilization field, each of which has been revised on occasion, including the preparation of numerous specific wage ceiling orders; replying to letters involving legal problems concerning wage stabilization; writing opinions; acting as examiner in wage stabilization cases and reviewing such cases; assisted in resisting efforts to procure court injunction affecting stabilization activities; advised regional and other conferences in legal questions arising in the program; prepared suggested forms for administrative use and conferred and advised with regional attorneys concerning legal questions arising in the program in the field; considered authority to subpoena witnesses and pay witness fees in connection with wage stabilization hearings.

Legal work on price matters included preparation of memoranda giving legal clearance of maximum price and other regulations and orders on agricultural products and other products and advised concerning the effects of various pieces of proposed legislation; interpreted the statutes and executive orders with respect to the authority of the Secretary of Agriculture on the Price Control Extension Act of 1946 and earlier similar legislation.

Legal work in connection with foreign agricultural relations included advice on numerous problems arising in relation to government contracts, claims and the operation of cooperative enterprises abroad; opinions were given interpreting proposed legislation and existing laws and other orders relating to agriculture in the foreign field; drafted and advised concerning proposed new organic legislation; reviewed and gave advice concerning revised proposed contracts between foreign governments and personnel entering their service; reviewed proposed international commodity trade agreements and reciprocal trade agreement drafts.

#### Commodity Loan and Purchase Programs

Basic Commodity Programs: Under this project is performed legal work incident to activities of the Commodity Credit Corporation with respect to the following commodities: Cotton, corn, wheat, peanuts, rice, tobacco, wool, sugarcane, sugar beets, dried beans, dried peas, grain sorghums, rye, soybeans, flaxseed, flax, naval stores, hay, broom corn, cottonseed, hemp, oats, barley, and the products thereof. These activities are as follows:

- (a) Price support activities, involving purchases, loans, and other operations with respect to basic, Steagall, and nonbasic, non-Steagall agricultural commodities.
- (b) Producer-loan programs for all basic, Steagall, and non-basic,

non-Steagall agricultural commodities.

(c) The making of food purchases to fill the needs of foreign governments, and relief organizations, including, where necessary, processing of food. It also includes transportation, handling, and warehousing of food, and other commodities purchased for these purposes.

(d) Subsidy operations designed to obtain the necessary production and distribution (without inflationary price rises) of agricultural and food commodities.

(e) The sales of agricultural commodities to foreign countries at competitive world prices.

Legal work in these fields has included the preparation and review of a vast number of contract forms and agreements; review of many purchase and price support programs, export programs, preparation of legal documents for warehousing commodities purchased and upon which loans are made, handling of a large number of claims both in favor of and against the Government, involving several hundred thousand dollars, rendering assistance to the Department of Justice on litigation arising out of claims, preparation of numerous legal opinions on a wide variety of questions, including contract activities and use of wartime powers by the Corporation, and legal work relating to the status of Commodity Credit Corporation as a Government Corporation, including its general powers and fiscal problems.

Commodity Supply Programs: Under this project is performed legal work incident to certain activities of the Commodity Credit Corporation with respect to livestock, meats, poultry, eggs, milk, cheese, butter, fish, fruits, Irish and sweet potatoes and other vegetables, miscellaneous food commodities, and products thereof. These activities are as follows:

(a) Price support activities involving purchases and other operations (except loans) with respect to processed foods and nonbasic agricultural commodities.

(b) Reconversion and contract termination.

(c) The making of food purchases to fill the needs of foreign governments and relief organizations, including, where necessary, the processing of food.

(d) Exporting or causing to be exported nonbasic agricultural commodities and products thereof at competitive world prices in order to obtain foreign outlets for surplus agricultural commodities. (Section 21(c) of the Surplus Property Act.)



(e) The transportation, handling, and warehousing of all food and other commodities purchased under any of the foregoing activities.

(f) Subsidy operations designed to obtain the necessary production and distribution (without inflationary price rises) of agricultural and food commodities thereof.

This project also involves legal work incident to activities of the Production and Marketing Administration as follows:

- a. All export, purchase and domestic diversion programs under Section 32, Public Law 320, 74th Congress, as amended.
- b. Formulation and administration of the school lunch program pursuant to the National School Lunch Act.

Legal work in these fields has included the preparation and review of a vast number of contract forms and agreements, review of many purchase and price support programs, export and diversion programs, preparation of legal documents in connection with the operation and disposition of over fifty-five lend-lease plant expansion projects, handling of a large number of claims both in favor of and against the Government some of which have involved as much as several hundred thousand dollars, the rendering of assistance to the Department of Justice in litigation arising out of claims and in the institution of criminal proceedings in connection with false claims, and preparation of numerous legal opinions on a wide variety of topics, including contract activities, surplus property, contract termination and relationships with other agencies.

#### Farm Credit Programs

The Office of the Solicitor furnishes legal services required by the Farm Credit Administration. The services relate to supervision of various incorporated credit agencies; the conduct of certain direct loan programs; assistance under the Cooperative Marketing Act of 1926 to farm groups through research and technical assistance in the development and maintenance of effective marketing, purchasing, and agricultural services to cooperative organizations; and the operations of the Federal Farm Mortgage Corporation. The corporate credit agencies supervised by the Farm Credit Administration are the Federal land banks; national farm loan associations; and joint stock land banks (in liquidation), operating under the Federal Farm Loan Act (1916); Federal intermediate credit banks, operating under the Agricultural Credit Act of 1923; and production credit corporations, production credit associations, and banks for cooperatives, operating under the Farm Credit Act of 1933. The direct loan programs administered by the Farm Credit



Administration are loans to farmers on behalf of the Federal Farm Mortgage Corporation under the Emergency Farm Mortgage Act of 1933; liquidation of a \$500,000,000 revolving fund for use in making loans to cooperative associations under the Agricultural Marketing Act; and loans by the Regional Agricultural Credit Corporation of Washington, D. C., under the Emergency Relief and Construction Act of 1932 and the Farm Credit Act of 1937.

During the fiscal year 1946 the Office advised the Farm Credit Administration regarding legal questions pertaining to internal operations, functions, and powers of the Farm Credit Administration; to its programs; and to its exercise of supervision over corporate credit agencies. This included legal advice relating to the terms and enforcement of loans of the various credit agencies and, as to the corporations involved, their investments, personnel practices, corporate procedures, rights and obligations under contracts, status as public or private corporations, and issuance and retirement of stock and other securities. The Office prepared or assisted in preparing regulations, orders, and bulletins issued by the Farm Credit Administration to govern the agencies under its supervision and its direct loan programs; prepared various legal forms; performed legal services with respect to legislation affecting the interests of the Administration and its agencies; prepared periodical summaries of legal cases relating to cooperative associations; and supervised or assisted in the conduct of civil litigation and reported civil and criminal cases to the Department of Justice. In addition to the foregoing, the Office performed special legal services in connection with farm credit programs as follows:

Long-Term Credit Programs: The Office continued work with the assistance of the legal staffs of the district Farm Credit Administrations on a broad study of title procedures with a view to simplification and economy to farmers who obtain mortgage loans from the Federal land banks and the Federal Farm Mortgage Corporation. During the fiscal year substantial revisions were made in mortgage and note forms in use, resulting in the shortening and simplification of the forms and a corresponding reduction in recording costs to borrowers. Legal assistance was furnished in connection with the calling of over \$340,000,000 of consolidated Federal farm loan bonds, borrowings aggregating \$112,500,000 by the 12 Federal land banks from commercial banks which were collateralized in part by a \$60,000,000 issue of consolidated bonds, and the issuance of consolidated bonds to the public aggregating approximately \$607,000,000. Legal advice and assistance was also given in connection with the completion of two receiverships and four voluntary liquidations of joint stock land banks.

Drafting services were performed in connection with a bill to

extend certain benefits under the Social Security Act to employees of national farm loan associations and production credit associations, and to impose the applicable taxes, and in connection with a bill to extend for two years the lending authority of the Land Bank Commissioner to make loans on behalf of the Federal Farm Mortgage Corporation.

Legal services were furnished in relation to two plans adopted during the fiscal year for the financial rehabilitation of national farm loan associations and in relation to certain litigation pending in the Supreme Court of the United States involving the rehabilitation plan adopted by the Federal Land Bank of Louisville.

Short-Term Credit Programs: The Office assisted in the institution and conduct of litigation in State and Federal courts involving short-term loans and collections; prepared deeds, leases, assignments, and other legal documents essential to the continued liquidation of assets in the Revolving Fund; assisted in working out problems arising in financing agricultural producers through the production credit system; reviewed applications for loans from the Central Bank of Cooperatives, and assisted in legal phases of the work of district banks for cooperatives; and furnished legal services in connection with the continued operations of the Regional Agricultural Credit Corporation of Washington, D. C.

The Office assisted in carrying out provisions of Public Law 518, 79th Congress, approved December 20, 1944, relating to the compromise, adjustment, and cancellation of indebtedness arising from loans made to farmers under certain Acts of Congress specified therein.

#### Farmers Home Administration

Farm Tenancy and Water Facilities Programs: Under this project is performed the legal work incident to the activities performed by the Farmers Home Administration, as follows:

(a) The making, servicing, and the collection of loans to farmers for the purchase, enlargement, repair, or improvement of farms under Title I of the Bankhead-Jones Farm Tenant Act, as amended. The special legal problems involve the preparation or review of opinions of title to real property, the negotiations for title insurance and approval or disapproval of title insurance problems, the preparation of various real estate loan and security instruments, and the foreclosure of real estate mortgages. The work requires a current and intimate knowledge of the laws relating to real estate title, mortgages and other security instruments, and fire, windstorm and title insurance. The change in the item "Farm Tenancy" of the Department of



Agriculture Appropriation Act, 1947, relating to the size of Title I loans has resulted in loan activity in many counties in which loans could not be made under the former limitation. Moreover, the 1947 funds were available to veterans without restriction as to the size of the loan, a fact which resulted in many additional loans even at current real estate prices. The increased volume and age of outstanding tenant purchase loans will, of course, result in more foreclosures, sales, transfers, partial and total releases, and other transactions incident to loan servicing and collection. The option secured by the purchaser and all the loan documents must be reviewed for legal sufficiency prior to the closing of these loans. Based on past experience, there will probably be some 300 cases requiring special legal servicing such as transfer of farms to other approved applicants, foreclosures, acceptances of deed in lieu of foreclosure, compromises, and leases during the current fiscal year.

(b) The sale, in accordance with tenant purchase procedure and standards of resettlement and rural rehabilitation project lands in liquidation which, pursuant to section 43 of the Bankhead-Jones Farm Tenant Act, as amended by the Farmers' Home Administration Act of 1946, and Public Law 563, 79th Congress, 2nd Session, approved July 30, 1946, are found suitable for the purposes of Title I of the Bankhead-Jones Farm Tenant Act and loans for improvement thereof. This work involves substantially the same legal problems as are indicated in paragraph (a) above. The latest figures indicate that something like 350 of such units remain to be sold. In addition to these units, however, some 1,800 of such units have already been sold, mostly on long-term credit requiring continued servicing and collection.

(c) The making, servicing, and collection of loans for the construction or repair of facilities for the conservation and utilization of water by farmers in the arid and semiarid areas of the United States pursuant to the Act of August 28, 1937, known as the Pope-Jones Water Facilities Act (50 Stat. 869). These programs involve problems incident to the making and servicing of loans to individuals or groups or associations of farmers for the construction and development of wells, ponds, ditches, reservoirs, pumping installations, irrigation systems, farmstead water systems and other facilities for water storage and utilization and appurtenances to such facilities for the purpose of providing water for domestic livestock and irrigation uses. They also involve technical advice and guidance in connection with such loans and the planning and construction of such facilities. In addition to the usual title and security problems and the problems of Federal law, these programs require an examination of corporate organization of water users' associations and corporate management of facilities constructed with such loans, as well as the organization and operation of irrigation districts. The majority of such loans involve special problems

in connection with water rights under State laws. With the availability of construction materials, there will be an increased number of the projects which can be undertaken in this field. With the continued favorable agricultural situation, it is reasonable to expect that the present rate of full repayment of these loans will continue, resulting in additional legal work in connection with releases and modifications of loan instruments.

Rural Rehabilitation Programs: Under these programs there has been performed, during the past year, legal work incident to activities of the Farmers Home Administration, as follows:

(a) The making and administration of rural rehabilitation loans, flood loans, grants, and related activities, under the various acts appropriating funds to assist needy farmers, including (1) furnishing farm debt adjustment services, (2) making and servicing loans to individual farmers, and (3) servicing outstanding loans and grants previously made through Farm Security Administration and its predecessors. The legal work is of enormous volume and includes, as a major activity, the preparation of many legal forms and enforcement of promissory notes, chattel mortgages, and pledge agreements of various kinds. The more aggressive collection policy has substantially increased the legal work incident to this activity.

(b). The administration, as trustee, pursuant to agreements between the Secretary of Agriculture and forty-three State Rural Rehabilitation Corporations, of the assets of such Corporation in furtherance of rural rehabilitation in the respective states. This legal work is of considerable volume. It includes the making, servicing, and collection of rural rehabilitation loans and grants, administration and disposition of real estate, and related activities. The legal servicing is the more involved by reason of the complexities incident to the administration of trust estates by a Federal agency. In addition to the problems normally presented in this type of relationship, the administration and servicing is further complicated by the joint investment of Government and Corporation funds in the trust estates. The total assets of the forty-three separate trust accounts aggregate approximately \$52,000,000.

(c) The compromise, adjustment and cancellation of certain indebtedness specified in Public Law 518, 78th Congress, arising from loans and payments made and credit extended to farmers by the former Farm Security Administration. In addition to problems of legal interpretation, the Act also necessitated the preparation of instructions, forms and procedures, and review of individual case dockets.

Farmers Home Administration Act of 1946: The Farmers Home Administration Act of 1946, approved August 14, 1946, abolished the Farm Security Administration. Under the Act, the Farm Tenancy



provisions of the Bankhead-Jones Farm Tenant Act are being administered by the Farmers Home Administration. Rural rehabilitation loans and emergency crop and feed loans, which have heretofore been administered by the Farm Credit Administration, have been replaced by production and subsistence loans and likewise administered by the Farmers Home Administration. In addition, the Administration has charge of the trust estates in connection with the State rural rehabilitation corporations, the liquidation program begun by the Farm Security Administration, and the program under Public Law 518, 78th Congress. In connection with the trust estates, the Act directs the Secretary to liquidate the trusts and to negotiate with responsible officials to that end. The negotiations for liquidation of 43 separate trust accounts will create a workload primarily of a legal nature and possibly will include considerable litigation.

In accordance with Section 43 of the Farmers Home Administration Act, resettlement and rural rehabilitation project lands, including lands held by defense relocation corporations and land leasing and land purchasing associations, have been and are being disposed of by the Farmers Home Administration as economic farm units or surplus property. Such disposition necessitates the preparation of liquidation agreements, examination of sales dockets, preparation of bid forms, notes, deeds and mortgages. Pending liquidation of particular tracts, agreements for payments in lieu of taxes have been prepared and reviewed in numerous instances. Such payments have been made to local public taxing units pursuant to the Bankhead-Black Act.

The enactment of Public Law 563, 79th Congress, which directs that a preference be granted to veterans and present project occupants in the disposition of a part of such lands, has necessitated a revision of existing sales forms and procedures to meet the requirements of the Act.

#### Forestry, Research, and General Legal Services

Forestry and Lands Programs: This project includes legal work incident to the activities originating in the Forest Service, Soil Conservation Service, and otherwise, as follows:

(a) Forest Service activities, including the administration and extension of national forests; protection in collaboration with the states of the watersheds of navigable streams and the purchase of lands for the purpose of conserving the navigability of streams and to promote the continuous production of timber; the protection, in collaboration with the states, of forest lands and the reforestation thereof; the demonstration of reforestation, growing and utilization of timber and other forest products; the establishment and administration of

sustained-yield forest units; the establishment of fish and game sanctuaries in the national forests; cooperation with the states in the development of State forests and farm forestry; and the survey, construction, reconstruction and maintenance of forest roads and trails and forest highways.

(b) Soil Conservation activities, including extending on a cooperative basis the facilities of Departmental agencies to such State and local agencies as soil conservation districts, wind erosion districts, grass conservation districts, and others, under the Soil Conservation and Domestic Allotment Act, as amended; and providing for the operation and maintenance of systems for the delivery of water and the settlement of lands pursuant to the Case-Wheeler Act, as amended.

(c) Water activities, including all phases of water development, conservation, use and disposal, conducted by the Soil Conservation Service, the Forest Service, and under the staff offices of the Secretary.

(d) Mineral activities, including the leasing of mineral rights on lands, other than those subject to Reorganization Plan No. 3 of 1946, Sec. 402, administered by the Forest Service and Farmers' Home Administration, and over-all Departmental mineral problems considered by the Mineral Policy Advisory Committee.

(e) Land acquisition activities, including the preparation, procurement of abstracts and curative data and examination and approval of title to all lands acquired by the Department.

Legal work for forestry activities had included the preparation of opinions and the preparation and review of numerous contracts and agreements incident to the protection and administration of over 178,000,000 acres under the jurisdiction of Forest Service, including the administration and control of the sale of timber from and the occupancy and use of such lands.

In connection with soil conservation activities the office prepared opinions and prepared and reviewed numerous documents relating to the Department's activities in land utilization, soil and water conservation, and flood control, including cooperative agreements with states and other agencies incident to the administration of the land utilization areas which comprise over 7,000,000 acres under the jurisdiction of the Soil Conservation Service, and reviewed documents and participated in the drafting of State legislative bills pertinent to the nearly 1700 soil conservation and other districts which embrace over 776,000,000 acres. Legal services in connection with the water conservation and Case-Wheeler programs involved the preparation of opinions and the drafting, examination and review of agreements relating to the acquisition of land, the delivery of

water, and the improvement, development and settlement of project lands.

Water activities included the preparation of opinions and review of dockets, reports and inter-departmental agreements and other legal instruments in connection with flood control work as authorized by the Flood Control Act of 1944. The office has conferred on pending Federal legislation pertaining to drainage activities and prepared analyses of State laws with reference to Federal cooperation with local drainage organizations. It has also reviewed and prepared analyses of other proposed legislation relating to valley authorities, water pollution and irrigation.

Mineral activities performed by the office included the preparation, review and interpretation of mineral leases, the examination of the qualifications of lessees, approval of performance bonds, and the examination of applications for surrender and assignment of mineral leases. Such activities will continue except as to certain lands named in the Reorganization Plan No. 3 of 1946, Sec. 402, transferring the functions of the Secretary of Agriculture relating to the mineral deposits in such lands to the Secretary of the Interior.

The legal work in connection with land acquisition included preparing and procuring abstracts of title, examination and approval of titles to all lands acquired by the Department, review of claims under Public Law 120, 78th Congress, and the preparation of quitclaim deeds to perfect title in many cases.

Legal services were also performed in connection with litigation involving trespasses and questions of title to lands administered by the Soil Conservation Service and Forest Service.

Research and General Legal Services: This project includes the legal work incident to the activities of the Agricultural Research Administration and its eight constituent bureaus which carry on the research work of the Department, including the four Regional Research Laboratories established under the Agricultural Adjustment Act of 1938, as amended, and the State-Federal cooperative and grant-in-aid work with the State Experiment Stations and State Extension Services; patent advice and assistance, both in Washington and at the site of work, including such advice and assistance on cooperative military research projects; and activities of the Office of Budget and Finance, the Office of Personnel, the Office of Information, the Office of Plant and Operations, the Library, the general staff work of the Office of the Secretary and the general activities of the Bureau of Agricultural Economics.



Marketing, Regulatory Laws, and Transportation Programs

Marketing and Distribution Programs: Under this project is performed legal work incident to certain activities of the Department as follows:

- (a) The execution of marketing agreements for agricultural commodities and the issuance and enforcement of orders regulating the marketing of certain commodities, under the Agricultural Marketing Agreement Act of 1937, as amended.
- (b) The licensing of commission merchants, dealers, and brokers handling fresh fruits and vegetables in interstate commerce, under the Perishable Agricultural Commodities Act, and the regulation of trade practices through reparation and disciplinary proceedings.
- (c) Activities under the Anti-Hog Cholera Serum and Hog-Cholera Virus Act, the Produce Agency Act, United States Cotton Standards Act, Tobacco Inspection Act, Standard Container Acts, Peanut Statistics Act, Tobacco Statistics Act, Export Apple and Pear Act, Renovated Butter Act, Honey-Bee Act, Dairy Products for Export Act, and the farm products inspection provisions of the annual appropriation act.
- (d) The monthly publication of the decisions (Agriculture Decisions) of the Secretary of Agriculture relating to regulatory activities of the Department.
- (e) Food industry relations, including the organization and functioning of industry advisory committees, and matters pertaining to anti-trust prosecutions involving the food industry.
- (f) Priorities and allocations with respect to dairy products, fruits and vegetables, and special commodities including tobacco and tobacco products.

Legal work in this field has included the preparation of original, supplemental, and implementing food orders regulating the marketing and use of milk, butter, cheese, milk sugar, and other dairy products, canned and processed fruits and vegetables, fresh, dried, and dehydrated apples, citrus, grapes, peaches, pears, plums, and other fruits; onions, potatoes, and other fresh and dried vegetables; cocoa beans, oil of peppermint, tea, fish (salted and canned), spices, pickles, malt and other special commodities; eggs, turkeys, and other poultry and products thereof; and tobacco and walnuts. The Office has also performed legal services in connection with marketing agreement order programs regulating hops, fruits, vegetables, and milk; litigation under milk and other marketing orders, including assistance to the Department of Justice in the preparation and



presentation of cases; and the formulation and promulgation of milk orders, or proposed amendments thereto, with regard to the marketing areas of suburban Chicago, Cincinnati, St. Louis, New Orleans, Boston, Philadelphia, Washington, Wichita, Fall River, New York City, Dayton, and certain other marketing areas and reparation and disciplinary proceedings under the Perishable Agricultural Commodities Act. Activity under the Agricultural Marketing Agreement Act of 1937 has steadily increased in recent months, and this increase is expected to be even more pronounced during the remainder of this fiscal year and the following fiscal year. The Milk Programs are being extended, e.g., the Cleveland, Ohio, order became effective on August 1, 1946. These programs classify milk and prescribe minimum prices that handlers shall pay to producers. The scope of this work is indicated by the fact that the July 1946 milk pool under the New York Milk Order totaled approximately \$27,000,000. Price conditions and marketing conditions for milk are such that hearings must be held, from time to time, on proposed amendments in all of the 30 metropolitan marketing areas now under regulation. Some of these hearings, with respect to programs such as that for New York, Boston, or Philadelphia, are frequently protracted for a period of three or four weeks, and the transcript of the testimony consists often times of more than two thousand pages, plus the exhibits, for each hearing. The complicated character of milk regulation has been emphasized by the Courts, in litigation involving milk marketing orders, and in Queensboro Farm Products v. Wickard, 137 Fed. (2d) 969, the Second Circuit Court of Appeals stated that the milk problem, in conjunction with milk marketing orders "is so vast that fully to comprehend it would require an almost universal knowledge ranging from geology, biology, chemistry, and medicine, to the niceties of the legislative, judicial, and administrative processes of Government".

An indication of the trend of work in connection with these promulgation hearings may be obtained from the following statistics:

<u>Fiscal Year</u>	<u>No. of Promulgation Hearings</u>	<u>No. of Days at Promulgation Hearings</u>	<u>Pages of Transcript of Testimony</u>	<u>Pages of Exhibits Submitted as Evidence</u>	<u>Pages of Briefs Submitted</u>
1945	15	45	7,265	487	995
1946	27	94	14,010	740	1,826
1947(7/1/46 to 2/26/47)	22	52	8,128	515	324

The marketing agreement and order programs for fruits and vegetables are likewise becoming more active since the cessation of

hostilities. In the last few months hearings have been held (1) on amendments to the Florida Citrus Program, and (2) on a new program for Florida Celery.

Administrative proceedings under the Perishable Agricultural Commodities Act and other regulatory acts under these programs have been constantly increasing since the cessation of hostilities and it is anticipated this increase will be greater in the coming year.

The requirements of the Administrative Procedure Act impose additional legal work with regard to all of these regulatory activities.

General Regulatory and Transportation Programs: Under this project legal work is performed incident to certain activities of the Department, as follows:

- (a) Activities under the United States Warehouse Act.
- (b) Price support programs with respect to livestock, livestock products, fats and oils, dried beans and dried peas.
- (c) The regulation of sugar marketings in interstate and foreign commerce by the imposition of quotas, under the Sugar Act of 1937, as amended.
- (d) The regulation of the business conduct of poultry dealers and handlers, packers, stockyard owners, and dealers and market agencies at stockyards, operating in interstate commerce and the prescription of rates and charges assessed by such individuals under the Packers and Stockyards Act.
- (e) The regulations of trading in futures contracts for delivery of grains, cotton, wool and other commodities on commodity exchanges and boards of trade, and the regulation of the conduct of such exchanges and boards, and the traders and commission merchants operating thereon, under the Commodity Exchange Act.
- (f) The establishment of standards of quality and condition of wheat, corn, and other grains and the prohibition of the interstate or foreign transportation of grains not officially inspected and graded under the United States Grain Standards Act.
- (g) The regulation of interstate and foreign commerce in seeds under the Federal Seed Act.
- (h) The prevention of the interstate or foreign shipment of meat and meat food products which are unfit for human consumption, under the Meat Inspection Act and Patman Amendment.
- (i) Prosecution of cases with respect to rates, charges, tariffs, practices, and abandonments relating to the transportation of farm products before the Interstate Commerce Commission, the Federal Courts and the State Public Utilities Commissions.

(j) Activities under various other regulatory statutes, including the Cotton Futures Act, Insecticide Act, Naval Stores Act, Virus-Serum Toxin Control Act, Plant Quarantine Act, Animal Quarantine Act, Wool Standards Act, the Twenty-Eight Hour Law, the Farm Products Inspection Act, and other acts designed to prevent shipment of diseased livestock and the introduction or dissemination of contagious animal diseases.

(k) Enforcement of food orders and regulations.

(l) Priorities and allocations with respect to the grain and livestock groups of agricultural commodities, fats and oils, and sugar and molasses.

Legal work in this field has included the preparation of original, supplemental and implementing food orders regulating the marketing and use of livestock, meat, meat products, fats and oils, fats and oil products, sugar, molasses, corn, flaxseed, wool, bakery products, dried beans and peas, rice and other products; the preparation of legal interpretations of such orders; the preparation of regulations and amendments thereto under the statutes mentioned above and of proposed amendments to such statutes; the preparation of opinions interpreting such statutes and regulations; the preparation of legal opinions, pleadings and other legal documents required in judicial and administrative actions instituted under said statutes; assisting the Department of Justice in the preparation and presentation of cases arising under such statutes; representing the Department in all administrative hearings under such statutes; the preparation of memoranda and regulations on compliance with War Food Orders; and general supervision of compliance activities in the administrative and court (criminal, civil and equity) proceedings by regional attorneys in the enforcement of War Food orders.

The trend of legal work in connection with War Food Orders is indicated by the following table:

	Fiscal Year <u>1945</u>	Fiscal Year <u>1946</u>	7/1/46 to <u>2/26/47</u>
Number of orders, delegations, directives, and amendments thereto issued	175	218	108
Number of cases arising in connection with enforcement:			
Warning letters	485	103	186
Administrative hearings	166	14	1
Civil suits	281	48	20
Criminal suits	362	244	63



the legal work involved in connection with the enforcement of the Packers and Stockyards Act should increase considerably during the next fiscal year due to the fact that the number of auction markets and other livestock marketing centers has increased considerably during the last few years and many cases of a complicated nature involving rate hearings and disciplinary hearings have been held in abeyance during the war emergency. During the past few years approximately 125 decisions involving this Act were reported each year.

Section 201 of the Agricultural Adjustment Act of 1938 authorizes the Secretary of Agriculture to appear before the Interstate Commerce Commission and Federal courts in connection with the rates, charges, tariffs, and practices relating to the transportation of farm products. Various acts administered by the Department identify the Department as a shipper so that it may appear in the public interest before and secure relief from various transportation regulatory agencies such as the Interstate Commerce Commission, the Maritime Commission, and others. This type of work was initiated in 1938 and the work load has increased continuously since that time. The following table shows the work load for the fiscal years 1945, 1946, and 1947:

<u>Interstate Commerce Commission:</u>	<u>1945</u>	<u>1946</u>	<u>1947*</u>
Complaints	23	38	40
Investigation and Suspension			
Proceedings	12	12	24
Abandonment cases	17	4	2
<u>State Commissions:</u>	5	-	12
<u>U. S. Maritime Commission:</u>	1	7	12
Totals	58	61	90

\*Projected for remainder of year on basis of cases on hand.

In each of the above cases attorneys of the Solicitor's Office prepared pleadings pursuant to which the Secretary of Agriculture became a party, assisted and conferred with all witnesses appearing on behalf of the Secretary, assisted in the preparation of their testimony and exhibits, served as counsel at hearings, prepared briefs and other post-hearing instruments, made oral arguments before the agencies indicated, and handled correspondence among counsel. The work load cannot be accurately appraised, however, from the number of cases because some cases are more detailed, involved, and burdensome than others. For instance, some cases entail the preparation of numerous involved pleadings, weeks of hearings, and the presentation and analysis of hundreds of exhibits. It is anticipated that this work will continue to increase at an accelerated rate for the next few years.



During the fiscal year 1945 and the early part of the fiscal year 1946, a total of seven formal cases under the Commodity Exchange Act was initiated. This small case load is attributed to the following facts: (1) during the war years, trading in commodities virtually ceased; (2) the distribution of these commodities was taken out of normal channels by huge governmental purchase programs; (3) the establishment of maximum prices which, in view of short supplies and large demands, in fact became the market prices; and (4) there has been a considerable shortage of personnel in the administrative branch. With the rapid return of the nation to a normal peace time economy, it is anticipated that the case load will greatly increase.

The volume of trading on commodity markets has increased considerably in recent months. This is undoubtedly due to the removal of wartime restrictions affecting the distribution and price of the commodities in question, coupled with existing purchasing power. The withdrawal of the Government from the market because of the discontinuance of Government purchase programs and the liquidation of UNRRA, which was a pertinent factor in procurement, will further stimulate trading. Research and development during the war in connection with materials and facilities needed by the armed forces have uncovered new uses for many of the commodities in question or for their by-products, and have pointed the way for new possibilities for these commodities in commercial fields. It is reasonable to assume that American manufacturers and businessmen will adapt their techniques to such new uses and that new products made in whole or in part from the commodities in question will appear on the market. This factor will naturally increase the demand for commodities subject to CEA regulation and will further stimulate trading on the commodity markets.

The following table indicates the number of formal cases handled by the Solicitor's Office in connection with enforcement of the 28-Hour Law, Meat Inspection Act, and the Animal Quarantine

Acts:

	<u>F.Y. 1945</u>	<u>F.Y. 1946</u>	<u>7/1/46 to 2/26/47</u>
28-Hour Law	512	427	299
Meat Inspection Act	36	25	20
Animal Quarantine	1	1	5

In addition, many cases were examined but returned to the program agency due to lack of facts to justify prosecution.

The number of cases handled in connection with the Packers and Stockyards Act is reflected by the following table:

	<u>F.Y. 1945</u>	<u>F.Y. 1946</u>	<u>7/1/46 to 2/26/47</u>
Reparations	27	36	8
Disciplinary	53	26	41
Rate	10	1	0
Cases in Courts	3	6	0

Rural Electrification Programs

Electrification Loans: In general, this project includes legal work incident to an REA project: (1) prior to the construction period; and (2) in connection with security servicing. The core of the work is similar to that of a private law office specializing in investment banking. It involves the preparation of loan contracts, notes, bonds, mortgages, trust indentures and related documents; supervision of the corporate action of borrowers; and other legal activity necessary to insure the validity of the government loans and the security therefor and to protect and service such security. In addition to these matters that are common to all long-term corporate financing, there are other matters growing out of the facts that the lender is the government and the cooperative borrowers represent a unique development in the electric light and power industry. Without attempting a complete enumeration of functions, the following are illustrative:

- (a) Examination of each loan docket, prior to allocation, to determine: (1) whether all purposes of the loan are within the provisions of the Rural Electrification Act of 1936 as amended; (2) whether any matters of state law require special attention or modification of the project; and (3) whether the docket represents a body of evidence sufficient to justify the Adminis-

strator's certificate of "feasibility" under the standard prescribed by the basic REA legislation.

(b) Preparation of loan contracts, notes, bond, mortgages and trust indentures, evidencing the loans and the security therefor.

(c) Preparation of corporate resolutions of meetings of cooperative directors and members necessary to validate the loans and their security. With respect to loans to public agencies, preparation of ordinances, bond resolutions, etc., and supervision of validating procedures.

(d) Instructions to local counsel of borrowers. These are now highly standardized, though numerous legal differences in the several states must be taken into account. In addition to general instructions, it is frequently necessary to conduct extended correspondence in special matters.

(e) Determination of a variety of matters to be contained in opinions submitted by local counsel of borrowers and examination of such opinions after submission thereof.

(f) Examination of a variety of documents as follows: all loan documents, to assure proper execution; mortgage recordation certificates, to assure proper recording in all counties where facilities are to be constructed; requisite certificates of regulatory bodies; and others.

(g) Preparation of frequent amendments to loan contracts and supplemental mortgages, either at the instance of the REA Administrator or because of the requirements of state law.

(h) Special work of importance and complexity in connection with the acquisition by borrowers of existing electric facilities, including the conduct of formal closings.

(i) Consolidation and reorganization of borrowers, transfer and conveyance of property between borrowers, and sales of property by borrowers to other parties.

(j) Maintenance of security for loans and enforcement of security rights, including preparation or review of all documents necessary in connection therewith.

(k) Preparation, and supervision of the authorization and execution of refunding documents incident to reduction of interest rate and extension of the amortization period resulting from the provisions of the Department of Agriculture Organic Act of 1944 (58 Stat. 734).



Electrification Construction and Operations: The legal work under this project falls broadly into two categories: (a) Legal matters incident to construction of projects, and (b) Legal matters incident to operation of systems.

(a) Legal matters incident to construction of projects--this category primarily involves business law incident to the electric light and power industry. It grows out of the fact that the Rural Electrification Administration is much more than a banker and is responsible for a social program, requiring close supervision of its borrowers' construction activities. Legal work of this kind resulting not only from an expanded loan program but also from the acceleration of construction on projects where shortages of critical materials caused deferral of construction during the war years, will cause a vast increase in such type of legal work during fiscal year 1948.

1. Preparation or review of contracts between borrowers and parties other than the government, all of which, under REA loan contracts, require the approval of the Administrator. These include contracts for construction, engineering, purchase of materials, wholesale energy, crossings of railroads and other powerlines, arrangements with telephone companies respecting inductive interference, and other miscellaneous matters.
2. Relations between borrowers and their contractors, including awards under competitive bidding, legal disputes, claims under surety performance bonds, etc.
3. Legal aspects of insurance coverages by borrowers and their contractors under REA requirements.
4. Highway permits from state, county and local authorities require important legal attention by way of instructions to local counsel and examination of proofs submitted.
5. Examination of opinions of local counsel and certificates of cooperative managers with respect to private rights-of-way. The lines already financed by REA have required more than 1,500,000 separate easements. Although attorneys in the Solicitor's office do not, of course, examine these separate instruments, they must examine over-all proofs submitted by borrowers and supervise, by way of general and special instructions, the obtaining of a lawful right-of-way for government-financed lines. In certain competitive situations this matter has critical importance.



6. Title work in connection with sites for office buildings, substations, generating plants, and also in connection with acquisitions of existing electric facilities.

(b) Legal matters incident to operation of systems. Most of this workload is fairly constant from year to year, regardless of the volume of new projects. There will be an abnormal expansion in practically every item in fiscal year 1948, owing to the rapid expansion of the REA program and the close interrelation between new loans and the operation of existing systems of borrowers.

1. Preparation or review of articles of incorporation, by-laws and corporate resolutions with respect to new borrowers. Also amendments of articles and by-laws with respect to existing borrowers.
2. Tax matters, state and federal, presenting a number of problems peculiar to the cooperative method of doing business.
3. Negotiation and renegotiation of wholesale energy contracts.
4. Proceedings before regulatory bodies involving rates and other operational matters.
5. Contractual relations of borrowers among themselves and with others.

Electrification Consulting: The legal work under the project falls broadly into three categories: (1) litigation; (2) research and consulting work in connection with state legislation; and (3) negotiations and conferences with state officials and officials of other government departments, and the rendering of technical legal advice and assistance to attorneys for REA cooperative borrowers and to the REA administrative staff on a variety of special matters related to the REA program but not necessarily directly related to the loan, construction, or operation phases of such program.

The litigation work is chiefly concerned with certificates of convenience and necessity, authorization of the issuance of obligations to the government, or other necessary authorizations from state regulatory bodies but also includes many important court proceedings in which the Rural Electrification Administration is interested. These proceedings involve either the security for the Government loans or basic problems of program policy or the effective conduct of the program. For similar reasons, the Solicitor's office must give attention to many uncontested proceedings before regulatory bodies.

The legislative work includes the making of studies of the laws of the various states and proposed amendments to such laws, affecting rural electrification and REA borrowers to determine the extent to which such laws or legislative proposals are adequate and congenial to a proper development of the rural electrification program—the results of such studies being made available, upon request, to public officials, farm bodies, and REA borrowers in the several states.

#### Field Activities

Pursuant to the policy of the Solicitor's Office as reorganized in July 1942, responsibility has been delegated insofar as possible to regional attorneys in the field offices. The regional offices have performed all phases of legal work in connection with the program activities of the Department carried on in the regional area of the component agencies.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated Obligations, 1947	Estimated Obligations, 1948
<u>Working Fund, Agriculture, Office of</u>			
<u>Solicitor,</u>			
<u>Advance from Public Buildings Admini-</u>			
<u>stration:</u>			
For special allowances to employees:			
incident to their return to Wash-			
ington, D.C. from Kansas City,			
and St. Louis, Missouri, in connec-			
tion with recentralization of FCA			
and REA .....	- -	\$14,475:	- -
<u>Supply and Distribution of Farm Labor:</u>			
Legal services in connection with			
the farm labor supply program <u>a/</u> ....	\$45,280:	40,480:	- -
<u>Penalty Mail Costs, Department of Agri-</u>			
<u>culture (Allotment to Office of</u>			
<u>Solicitor):</u> For cost of penalty mail			
pursuant to Section 2, Public Law			
364, 78th Congress .....	1,718:	2,500:	\$3,100
<u>War Assets Administration:</u>			
Legal services in connection with			
the disposition of surplus agricul-			
tural commodities and agricultural			
and forestry lands <u>b/</u> .....	22,085:	47,420:	50,000
<u>TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL</u>			
<u>FUNDS</u> .....	69,083:	104,875:	53,100

a/ Allotment from funds appropriated on a calendar year basis for the farm labor supply program in a separate act. Availability of present funds appropriated for this program is limited to June 30, 1947.

b/ Schedule which includes these funds is carried in a separate chapter of the Budget.





OF ICE OF INFORMATION  
(a) Salaries and Expenses

Objectives: To coordinate and supervise the publication (including editing, indexing, illustration, and the procurement of printing) and the distribution of bulletins, documents, and reports on agricultural subjects of value and importance to farmers and others; to utilize all media of communication (including publications, press, radio, motion pictures, and exhibits) in presenting agricultural information to farmers and the public generally; to function as a staff office of the Secretary of Agriculture in carrying out the Department's responsibilities.

Need for Activities: The organic act creating the Department of Agriculture specified that it acquire and diffuse useful information on agriculture in the most general and comprehensive sense of that word. The Department is a research and service institution for the general welfare of the people of the United States. Information work, therefore, is a vital part of the programs and activities of the Department, and the function of the Office of Information in coordinating and supervising this information work serves all of the various responsibilities and activities required of the Department.

In this function, the Office of Information participates in helping farmers achieve and maintain efficient production and marketing of their crops and livestock; farm and city families use food and other farm products in the improvement of their health and welfare; and scientists and technicians disseminate research information and data on agricultural and related subjects.

In addition, the Office of Information functions as a service agency for bureaus of the Department in fulfilling their printing, publication, and distribution needs. It performs a management function in supervising the use of printing and binding funds, in the utilization of these funds most economically in the procurement of printed supplies and publications, and in the distribution of publications and other information materials.

Requests Received for Information: Requests for information (including publications) from farmers, the general public, and Members of Congress increased nearly 20 percent during the fiscal year 1946. Congressional requests alone increased nearly 50 percent.

<u>Fiscal Year</u>	<u>Total Requests</u>	<u>Congressional Requests</u>
1945	727,800	196,455
1946	871,687	291,287
Percentage Increase		
1946 over 1945	19.8%	48.3%

Requests during the first four months of the fiscal year 1947 were approximately equal to the corresponding period a year ago -- 60,000 a month.

The importance of this function in the Office of Information program is illustrated by the fact that in the fiscal year 1947, more than one-fourth of the total manpower in the Office will be devoted exclusively to the handling of requests for information.

Publication Activities: Inadequacy of printing funds with consequent inability to meet the Department's publication requirements marked last year's activity in this field. Depletion of stocks of over 180 Farmers' Bulletins was the most serious publications problem encountered in the Department in many years. The increasing need for printing of some deferred publications was coupled with the progressively more rapid rate of exhaustion of printing funds as the year advanced. The situation grew more difficult as it became more and more apparent that unit printing costs were continuing the rising trend which began early in 1942. The depletion of publications printing funds called for an exhaustive review of all the Department's periodicals, reprints, and publications to screen those most urgently needed, and to defer the printing of all others. It became necessary to apply even more drastic deferment of publications, and administrative materials as well, than was required during the most critical period of short paper supply. During the fiscal year 1946 a total of 329 new publications were printed, and 194 publications were revised where necessary; and reprinted.

Controls on distribution of duplicated materials and the limited supplies of printed publications were maintained. For example, approximately 404,400 pages of paper were saved during the year by reducing copies and number of pages on orders for printing and duplicating.

The Office continued to perform its staff function of working with bureau editors in further stimulating improvement in routing, editing, and co-ordinating the subject matter of Department publications, and streamlining the progressive steps of publication preparation, editing and printing. This phase of the Office's management work will be pushed forward as much as possible in the future.

Printing Management: A total of 3,229 printing requests were handled in 1946 -- a reduction from the 1945 total of 3,975. The greater part of this reduction was due to fewer orders on reduced printing funds, to consolidating orders, to checking existing stocks and recommending that standard and Department forms be used in lieu of proposed "special" forms, and to a smaller number of orders resulting from changing from cut to snap-out (carbon-interleaved) forms. The number of calls upon the printing technicians to advise directly on technical matters in planning the printing and distributing of necessary publications for the Department, and for special work continued through the year. The stoppage on printing during the latter part of the year increased the load of telephone and personal calls for information and service on pending bureau printing orders. This also required additional work to schedule most essential work ahead of materials that had to be deferred until printing funds become available in 1947.

A total saving of \$5,357 averaging \$446 per month, was made in handling all printing orders by changing paper stocks and sizes, and by other technical changes in printing orders. Economy in ordering was applied to purchases of all transportation requests, bills of lading, and required records maintained on each of these items.



Currently, the excess of needed printing over the funds available therefore will require a much more frequent check on the rate of obligation throughout the fiscal year. This plus the necessity for delayed scheduling, resulting in extra handling of bureau requisitions, will add about 20 percent to the clerical workload of the printing unit; and will delay regular printing procurement operations accordingly.

Exhibits Service: Work was continued in getting information before the rural public by means of educational exhibits produced in various types and sizes to meet specific needs. Two issues of small portable exhibits were produced in large quantities, and used by field agents of the Department. These consisted of 800 units of Rural Electrification subject matter and 1,050 units of a display on the 7-Point Cotton Program. Through agreements reached with State Extension Services in each of the cotton-growing states, these last mentioned exhibits will be distributed one per county in those states, and shown at fairs, in window displays, at meetings, schools, and other occasions.

For medium-sized fairs or other public gatherings, six new permanent type exhibits of approximately 30 feet in width were produced portraying late developments with respect to plants, livestock, farm machinery and equipment, Department services available to water users in the West, and 4-H Club work (two exhibits). For larger fairs, four additional existing carload groups of exhibits were reviewed, brought up to date factually, and put in condition for use -- which together with those groups previously revised, and through use of the new crop, livestock, and machinery exhibits, as a combined carload group, makes a total of seven large groups of exhibits.

The development of an exhibition program at larger fairs was begun, as restrictions on transportation were removed. Displays were made at two Florida fairs early in 1946, and plans were developed with fairs and expositions for additional showings of Department exhibits to the fullest extent that available exhibits made possible during the season of 1946. However, the demand for exhibits from fairs cannot be taken care of with exhibits now ready, making it necessary that additional existing unassigned units not contemplated in the season's program be renovated and pressed into service before going freely into development and production of completely new exhibits for the 1947 season.

During the 1946 summer and fall fair season, eight carload exhibit groups moved on exhibition circuits. Also, several smaller units were sent to smaller fairs, and a special unit on Department services to water users was shown at seven points in the West. Other showings will also be made from time to time throughout the spring of 1947. Production also is well under way on a soil and water conservation exhibit, and on cotton farming exhibits. Several smaller new exhibits (14-16 feet wide) also will be produced to augment exhibit resources for the 1947 exhibition season.

Radio Service: The Radio Service arranged or produced a number of radio services: (1) On the "American Farmer," a 30-minute weekly feature on 108 ABC stations, special agricultural news and features. (2) On the

"National Farm and Home Hour" program, a weekly feature of NBC broadcast on 157 stations, the Radio Service presents special news and features on agriculture and home economics. Other network activity included the arrangement or production of more than 100 special farm or home features on various networks. All network time is supplied without charge to the Department.

The regular background letter containing current agricultural information to 210 station farm directors, which the directors may use at their own discretion to guide them in planning their services to farmers, was continued throughout the year. The Radio Service took over full responsibility for a similar weekly letter to directors of women's programs on 485 stations.

Regular script services for farm and home broadcasts were maintained to State extension editors and individual stations for use in coordinated Federal-State broadcasts. Over 800 stations benefited by these services. Radio departments of the press associations were regularly supplied with information requested for use by their client stations.

The plan developed for the Department's western radio representative to give fuller service and radio training to western farm program directors on individual stations and to extension editors was carried out. One feature of this service is radio schools for extension and other agricultural workers using radio. A similar plan for serving the eastern part of the country was put into effect during the latter part of the year. About 55 such schools were held in the past year. These will be followed by other schools at the rate of about eight per month during this year.

Press Service: To serve all inquiries for information, including those made in person, by telephone, wire, or writing the Press Service provided the following: Press releases were given immediate handling to wire services, many daily newspapers, and other publications maintaining full-time writers. In addition, many copies were used for administrative purposes and for writers and others who daily collect releases in which they are interested; the Daily Summary, a compilation of all releases issued each day including reports prepared in the Bureau of Agricultural Economics, the Production and Marketing Administration, the Office of Foreign Agricultural Relations and other bureaus and offices of the Department of Agriculture; the weekly Clip Sheet, a five-page release prepared primarily on departmental research for scientific and all publications and writers who request it; and Food and Home Notes, a six-page weekly release prepared primarily for women's pages and women's magazines, but available also to those who are engaged in distributing food and home information to others including State extension editors and county home demonstration agents. In addition, the Press Service <sup>supplied</sup> to editors and writers, on request, pictures from its files; and a weekly letter on new developments in Department programs and research work at the State Agricultural Colleges for the information of farm and livestock editors.



Motion Pictures: During the fiscal year 1946 the Motion Picture Service completed 12 motion pictures as follows: CURING PORK COUNTRY STYLE—How to cure pork by the "dry" and "brine" methods; FREEZING FRUITS AND VEGETABLES—How to freeze fruits and vegetables; HAY IS WHAT YOU MAKE IT—How to improve the quality of hay; CROP INSURANCE—Why farmers should insure their crops; FARMERS FACE THE FUTURE—Wartime accomplishments of farmers and postwar agricultural problems; BOB MARSHALL COMES HOME—Veteran's plea to his REA cooperative; IN COMMON CAUSE—Accomplishments and operations of soil conservation districts; MEATS WITH APPROVAL—Government inspection of meat; LA TIERRA NUESTRA—Improvement of farming practices in Puerto Rico; QUERER ES PODER—Improvement of nutritional conditions in Puerto Rico; SOME PICKIN'—How to pick cotton; VETERANS AND THE LAND—Suggestions to veterans.

Additional pictures which have been started and will be completed during the fiscal year 1947; Feeding farm animals; causes and control of brucellosis; economic factors influencing cotton; factors in appraising a farm; control of white pine blister rust; functions and operations of Federal Land Banks.

The Motion Picture Service continued during the fiscal year 1946 to supervise the distribution of Department films, which were shown to an estimated 10,000,000 people during the year. Two special jobs were also performed: (1) Handling the distribution, after the termination of OWI, of a nutrition film, SOMETHING YOU DIDN'T EAT, which was shown to 1,500,000 people from January to June 1946; and (2) handling the distribution of three famine films (16mm), which during May and June 1946, were seen by an estimated 2,610,000 people.

(b) Printing and Binding

This appropriation provides funds for printing essential (1) to the procurement of a wide variety of forms, schedules, certificates, statistical and annual reports, and administrative materials indispensable to the operation of the agricultural programs for which the Department is responsible; (2) to making known to the public results of research conducted in Department laboratories and field experiment stations; (3) to making available to farmers information for improving their farming operations; (4) to making available to the public generally essential information on agriculture; and (5) to keeping Department staff workers and collaborators in Washington and in the field advised of agricultural program developments.

Agricultural research activities and other programs administered by the Department require annually a large number of operating forms and printed publications. Printed forms include crop reporting schedules, standard and Department accounting, statistical and personnel papers, statistical tabulating cards and paper, engineer field books, markers, tags, labels, postcards, franks, letterheads; and a wide range of program forms such as agricultural conservation program applications and tabulation sheets. Also included are such related office materials as stenographers' notebooks, copies of Postal Guide, copies of hearings, budgets, Department telephone book, and Congressional documents. Responsibility is centralized in the Office of Information for reviewing printing orders to secure the maximum benefit from printing funds, and for procuring promptly and in sufficient quantities from the Government Printing Office or from commercial sources, when necessary, forms and printed matter indispensable to program and day-to-day work; and publications essential to reporting the results of research activities. By so controlling and planning printing expenditures, it is possible for all types of printing requirements to be met to a maximum extent within limits of available funds and to effect economies in appropriated funds by consolidating printing orders.

A total of 3,612 requisitions for printed materials were placed through the Government Printing Office in the fiscal year 1946. Of the total, 2,306 orders were for printing of job forms and letterheads and 250 were for new publications including 82 service and regulatory announcements. Reprints and revisions of publications totalled 253, including 159 farmers bulletin reprints. In addition 803 orders for periodicals, binding and other printing were sent forward during the year.

Examples of publications printed during the year are: Chemicals to Kill Weeds and Diseases in Cotton Beds; Grading Soft Red Winter Wheat at Country Points; Food Enriched, Restored, Fortified; Blue Mold Control in Tobacco Beds; Farmer Jones Timber Crop; Farm Buildings and Home Grown Timber; Handling and Storing Soft Corn on the Farm; Fattening Steers; Nutritive Properties of Pork; Method of Making Potato Silage; Breeding Better Vegetables for the South; Air Transportation of Agricultural Perishables; Facts About Fertilizers and Lime in the U.S.; Instructions on Processing for Community Frozen Food Locker Plants; Planning Your Farmstead Wiring and Lighting; Water and Our Forests; and Questions and Answers on Government Inspection of Processed Fruits and Vegetables.

Many of the authorized programs of the Department have been handicapped due to lack of sufficient printing funds. It became apparent early in the 1946 fiscal year that the continuing rise in unit printing costs was causing an unexpected drain on available printing funds. More recent printing cost increases have further decreased the purchasing power of appropriated printing funds. The use of a large proportion of available funds for necessary printing during the first eight months of the fiscal year required a complete freeze on printing new publications for the remaining four months of the year. It also prevented reprinting of any publications of which the supply became exhausted except a very inadequate number of Farmers' Bulletins, and required reduction in the issues of several Department periodicals. Reprints of over 100 Farmers' Bulletins out of print and estimated to cost \$35,000 were held over into July 1946 for rush printing on 1947 funds. Examples of the publications required to be held over follow: Longer Life of Poles and Posts; Grading Barley at Country Points; Results in Inbreeding Grade Holstein Cattle; Yellow Resistant Cabbage Varieties; List of Intercepted Plant Pests; First Aid for the Irrigator; Wheat Stem Maggots; Water Input Used for Field Crops; Standardization and Inspection of Fruits and Vegetables.

Likewise, it was necessary to defer until the beginning of the 1947 fiscal year printing of forms and administrative materials estimated to cost about \$108,000. Considerable difficulty was encountered particularly in meeting the seasonal needs for crop schedules for use in fiscal 1947, but required to be scheduled for printing in 1946.

In addition to these short-term backlogs, there is a further increase in the backlog of publications reporting on technical and research progress in the Department programs, those reporting on regulatory and other program activity, and reports of pure scientific research as a product of the Department's research activity.

It is expected that the purchase of some specialty forms now required to be obtained through GPO contracts rather than under Department contracts as in the past 13 years, will result in an increased cost of at least \$70,000 without increase in number of forms purchased.



## STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations: 1946	Estimated : Obligations: 1947	Estimated Obligations: 1948
<u>Salaries and Expenses, Marketing</u>			
<u>Services (Office of Information):</u>			
For coordination of informa-			
tional activities of the Depart-			
ment in connection with the			
work of food supply and famine			
emergency programs .....	- -	\$106,000:	- -
<u>Emergency Fund for the President,</u>			
<u>National Defense, Allotment to</u>			
<u>Agriculture (Office of Informa-</u>			
<u>tion):</u> For informational			
activities required by the			
President's Famine Emergency			
Committee .....	119,382:	- -	- -
<u>Working Fund, Agriculture, Office</u>			
<u>of Information, Advances from</u>			
<u>(For production of motion</u>			
<u>pictures):</u>			
<u>War Department, Army Air</u>			
<u>Forces</u> .....	- -	5,000:	- -
<u>State Department</u> .....	- -	10,000:	- -
<u>Treasury Department</u> .....	352:	8,498:	- -
<u>Veterans Administration</u> .....	21,247:	48,753:	- -
<u>Federal Land Banks</u> .....	- -	12,000:	- -
Total, Working Funds .....	21,599:	84,251:	- -
<u>Miscellaneous Contributed Funds,</u>			
<u>Department of Agriculture</u>			
<u>(Office of Information):</u> Trust			
fund deposited by cooperators			
for production of motion			
pictures and for costs of			
transporting exhibits .....	14:	16,000	\$6,000
<u>Supply and Distribution of Farm</u>			
<u>Labor:</u> For informational			
services for the farm labor			
supply program <sup>a</sup> .....	6,005:	6,646:	- -



STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS - Continued

Item	Obligations 1946	Estimated Obligations 1947	Estimated Obligations 1948
Penalty Mail Costs, Department of Agriculture (Allotment to Office of Information): For cost of penalty mail pursuant to Section 2, Public Law 364, 78th Cong. ....	77,288:	60,000:	73,400
TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL FUNDS .....	224,288:	272,897:	79,400

/a Allotment from funds appropriated on a calendar year basis for the farm labor supply program in a separate act. Availability of present funds appropriated for this program is limited to June 30, 1947.



LIBRARY. DEPARTMENT OF AGRICULTURE

Objective: The purpose of the Department of Agriculture Library, which serves as the National Agricultural Library, is to provide aid in the formulation and execution of the agricultural programs by the collection, organization, and use of the information contained in the agricultural literature of the world.

Significance and Necessity: It is recognized that effective library services aid in eliminating duplication of research and costly errors by bringing the wealth of experience, knowledge and judgment contained in the agricultural literature to bear on problems of agricultural research, production, marketing, distribution, economics, conservation, and administration. The acquisition of scientific, technical, economic, and agricultural publications and the application of bibliothecal techniques to this material in order to make the knowledge available to the staff of the Department is a necessary adjunct to effective administration of agricultural programs. The proper organization of the material in the collection by classifying, cataloging, listing, indexing and preparation of bibliographies is essential to the effective utilization of the world's agricultural literature. Library service has been extended to the field employees of the Department by coordinating and extending the facilities through inter-library loans and photoduplicating service.

This library is the only Federal library serving in the agricultural field and the country's most valuable source of agricultural information.

General Plan: The Library serves the staff of the Department through a central library in Washington, nine branches, ten subbranches and eleven stations throughout the country. Its services are also made available to public and private agencies and to individuals interested in agriculture. Through the monthly publication "The Bibliography of Agriculture," the research staffs of the Department (both Washington and the field), and the staffs of the Land Grant colleges and state Experiment Stations are kept apprised of the contents of the literature received. It also provides library research frequently needed as a basis for sound administrative decisions.

Summary of Recent and Current Activities: Examples of recent activities and accomplishments under this appropriation are cited by projects.

The National Library for Agriculture has reached a level of operation never attained heretofore. It is a "service" operation. The demands come from outside; hence no control over the demands can be exercised by the Librarian. The highest level of professional and technical assistance that can be given to the greatest number of users of the Library will continue to be, within available funds, the major objective of the Library system.

General Administration covers the planning, the over-all administrative work, the coordination of bibliothecal and Departmental points of

view. Emphasis, during the fiscal year 1946, was placed on management, on-the-job training, work simplification techniques and revising standards of performance for individual jobs. Several management studies were made. One of the major improvements in fiscal administration resulted from a proposal initiated by the Library to eliminate detailed listing of thousands of collections of fees for reproduction services scheduled for deposit into the Treasury. Approval by the Comptroller General of this proposal, speeded collections and saved approximately 1.5 man-years. Through job simplifications and revised procedures, the clerical costs on bibliofilm orders are now no greater than they were before the pay increases in the Federal Employees Pay Acts of 1945 and 1946. Thus, it has been possible to absorb two salary increases totaling 29 percent without raising the price of this photocopying service to its users. Over-all examinations and evaluations of library services are made frequently to assure effective service.

Acquisition of Publications, Preparation for use and Distribution underlies all work of the Library, as acquisition of publications by purchase, gift or exchange, and their preparation for use is the foundation for reference, circulation, and bibliographical services to the users of the Library.

The increasing workload, which has been characteristic of the entire Library for the past several years, has continued in this phase of the work. During 1946, 45,492 volumes were acquired by gift, purchase, and exchange compared with 36,670 volumes for 1945, and 30,939 for 1944. This was an increase of 24 percent in 1946 above the increase in 1945, and 42 1/2 percent above 1944. This indicates very clearly the trend in the amount of material being published in the field of agriculture which this Library, as the National Library of Agriculture, must acquire. This increased activity will continue in 1948 for four major reasons: (1) an increase of \$8,600 was granted in the 1947 appropriation for procurement of foreign publications; (2) the State Department has appointed publication officers in various countries and these officers are procuring large quantities of material for this Library; (3) increased activity in exchange with foreign institutions; and (4) cooperation with international organizations such as Food and Agriculture Organization and United Nations Educational, Scientific and Cultural Organization, and domestic organizations such as the American Chemical Society.

At present, a backlog of at least 75,000 pieces exists, consisting mainly of gift publications, which must eventually be reduced by recording, cataloging, and preparation for incorporation into the Library collection.

The cataloging work is current, except on gift materials which is approximately three months behind. The work of making inventories of the publications filed in the branch libraries has also been suspended due to pressure of other work.

Bibliographical Services embraces the preparation or review of all bibliographies issued by the Library, including the monthly Bibliography of Agriculture which provides an index to the literature in the field of agriculture. This publication is used extensively by



research workers throughout the world. Copies of the Bibliography are purchased and distributed to all parts of the world by Food and Agriculture Organization as a World Bibliography of Agriculture. Intelligent research cannot be undertaken before a search of the known literature on the subject is made. There were 56,966 items listed in the Bibliography of Agriculture in 1946 compared to 55,761 items in 1945. More items could have been listed but ceilings on both pages and funds for printing prevented further listings. In addition to the regular monthly Bibliography of Agriculture, about 100 special bibliographies were prepared to meet the most urgent Bureau needs.

The copying work under this project, which is nearly self-supporting through charges made on the basis of actual costs, completed 35,644 orders representing 1,649,000 pages of photoprints and microfilms. This is an increase of 78 percent above 1945. Collections for this service increased from approximately \$11,500 in 1945 to over \$51,000 in 1946. The increase was attributed to a large number of orders for reproduction of enemy technical and scientific data and reports released by the Office of the Publication Board established pursuant to Executive Orders 9568 and 9604. The Department of Agriculture Library is the repository for all Publication Board reports and documents on agriculture, including chemicals, lumber, textiles and lumber products. This phase of the copy work will probably continue into 1948, but at a much lower rate.

Reading and Reference Services covers the library functions of providing services directly to Department workers and others. This includes answering reference questions by telephone, verbally, or by mail, furnishing the desired publication, shelving the material, verifying references, and maintenance of the collection.

While as might be anticipated, use by war agencies and total Library circulation in Washington decreased slightly during fiscal year 1946 book circulation to Department staff continued to rise as compared with previous years even though a shorter work week was in effect. Reduction of the work week necessitated a decrease in the hours the Library is open after regular working hours, and the total of hours open per week was reduced from 68 to 64 in 1946. Nevertheless, both reference and circulation work handled per day increased. Reference workload increased from 316 questions per day to 336 per day and the average daily circulation rose from 1332 to 1405. Output per staff member under the 40-hour week is greater than it was under the 48-hour week, but in spite of that, curtailment of services such as periodical routing has been necessary. Maintenance of part of the collection in a building other than the main Library due to space limitations adds to the work to be performed.

The quality and promptness of service rendered under this project determines the immediate and direct usefulness of the library system.

Field Library Services with 19 field libraries, constitute the "nerve system" through which library needs of field workers are communicated to the Librarian and the required services are supplied. From the lone individual research worker to the concentration of Department staff at one field point, an attempt is made to serve the reference,

bibliographical, and circulation needs through the use of branch and sub-branch libraries. The field branches assist in the operation of the Department's many programs; they aid in getting published information to each man on the job, regardless of his location; they facilitate and extend existing library resources by use of inter-library loans, microfilm and photocopies; and they eliminate any need for large numbers of relatively little used books in all field offices.

A large part of the past increases in reference questions was attributable to war-related problems. With the end of the war, the total number of reference questions declined slightly to 82,149 in 1946 as compared with 87,470 in 1945. However, the average daily total increased from 280 in 1945 to 304 in 1946. More and more, the library staff time is consumed by circulation work, leaving less time for more intensive reference. The circulation of books and periodicals continued to increase. The total circulation in the field reached a new all time high of 1,320,461 in 1946

(See next page for a tabulation of actual and estimated workload under several major categories of activities)

# PRINCIPAL OVERALL VOLUME OF WORK STATISTICS

Actual Fiscal Years 1943-1946

Estimated 1947-1948

Activity	Actual				Estimated	
	1943	1944	1945	1946	1947	1948
Titles catalogued.....	7,254	10,465	11,073	11,386	13,500	20,000
New cards added to library catalogs..	a/115,000	63,117	a-b/104,596	c/101,394	102,000	110,000
Loans of books or periodicals and reproductions supplied.....	1,038,352	1,304,799	1,667,031	1,735,495	1,736,000	1,740,000
Serial titles entered.....	12,872	12,062	11,564	12,304	13,000	15,000
Reference questions answered.....	129,110	154,759	e/ 196,064	f/180,758	182,000	200,000
Volumes bound.....	5,669	5,236	9,544	d/ 6,504	5,000	<del>5,500</del> 5,280
Obligations for books, periodicals and other publications(Library funds)	46,784	43,939	44,872	42,738	51,000	51,200
Obligations for newspapers.....	1,191	1,164	1,077	1,191	1,200	1,200

a/ An unusually large number of cards added to field libraries.  
b/ Revised.

c/ The decline in 1946 was due to the suspension of the branch inventories work owing to urgency of other work.

d/ Includes Washington and field--Field statistics not available and therefore not included for prior years.

e/ Revised.

f/ A very large decrease early in the year was attributable to reduction in war-related questions, especially in the field. However, the number of questions received has been increasing monthly.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated Obligations, 1947	Estimated Obligations, 1948
<u>Working Fund, Agriculture,</u>			
<u>(Library) Advance from Public</u>			
<u>Buildings Administration:</u>			
For expenses in connection			
with the recentralization of			
employees from St. Louis and			
Kansas City, Missouri .....	- -	\$220:	- -
<u>Return of Excess Deposits for</u>			
<u>Reproduction of Photographs,</u>			
<u>Mosaics, and Maps (Library)</u>			
Trust fund for refund of moneys:			
received for photographic re-			
production in excess of cost of:			
making such reproductions ....	\$664:	11,200:	\$300
<u>Penalty Mail Costs, Department of</u>			
<u>Agriculture (Allotment to</u>			
<u>Library): For cost of penalty</u>			
mail pursuant to Section 2,			
Public Law 364, 78th Congress	2,433:	2,551:	3,163
<u>Cooperation with American Republics:</u>			
<u>(Transfer from State Department):</u>			
For training in library science:			
of trainees from other American:			
Republics <u>a/</u> .....	- -	- -	11,384
<u>TOTAL, OBLIGATIONS UNDER SUP*</u>			
<u>PLEMENTAL FUNDS</u> .....	3,097:	3,971:	14,847

a/ Schedule for this item appears under the State Department chapter of the Budget.



## BUREAU OF AGRICULTURAL ECONOMICS

Changing National and world conditions have had a profound influence on the work of the Bureau of Agricultural Economics, whose primary function is to study and interpret the economic problems of agriculture. Since pre-war years the volume of farm production has increased approximately one-third, with wide variations between areas. Prices, wages, income, and production costs all advanced. With the cessation of hostilities, certain readjustments have begun to take place and there will need to be substantial shifts from certain war-emphasized crops to other farm products in some areas. As foreign nations return to more normal production, further readjustments will be necessary. The role of the Bureau of Agricultural Economics is to maintain current basic economic data and to keep the country informed as to present developments and probable future trends. The following table embodies a few of the series prepared by the Bureau which serve to point out trends in agriculture. (Table 1.)

### Functions and Organization of the Bureau:

Recognizing the need for a readjustment of work, the Bureau after searching study, has regrouped its activities so as to carry out the responsibilities set forth in the Secretary's reorganization order of December, 1945. These functions are summarized below:

- (1) It is the primary agency in the Department for collecting and publishing agricultural statistics, and for conducting economic research and disseminating the results thereof.
- (2) It is charged with the general oversight and coordination of statistical matters and economic research throughout the Department.
- (3) It has the responsibility, as a staff agency, of supplying the Secretary's Office and other agencies of the Department with statistical data and economic analyses relating to current and proposed Department activities.

The first and third of these general functions merely restate the responsibilities which the Bureau was already carrying but the second broadens its scope somewhat so as to bring about greater coordination of all statistical and economic research within the Department.

The responsibility for leadership in general agricultural program planning formerly assigned to the Bureau of Agricultural Economics was transferred to the Office of the Secretary. In the reorganization of the work of the Bureau, the positions of the eight regional analysts were abolished, and the regional offices in the field closed. Personnel were either separated or transferred to work in cooperation with State agencies or to Washington. In effecting this reorganization care was taken to preserve the continuity of research work under way and to maintain to the fullest extent possible cooperative relations with State agencies.

The clarification and realignment of the Bureau of Agricultural Economic's functions and responsibilities was accompanied by a number of changes in the administrative organization of the Bureau. The positions of Associate Chief and four Assistant Chiefs were established. The Associate Chief not only serves as the principal assistant to the Chief of the Bureau, but is also responsible for coordinating and improving the statistical and economic research work of the Department. Each of the Assistant Chiefs is assigned responsibility for one of the following four fields of work within the Bureau: Agricultural Estimates; research in Production Economics; research in the field of Prices, Income, and Marketing; and research in the field of Farm Population. The work on "Agricultural Estimates" is covered under the subappropriation for Crop and Livestock Estimates.

Effective July 1, 1946, the Secretary of Agriculture approved a reorganization of the statistical functions of the Bureau and placed the "Agricultural Estimates, Bureau of Agricultural Economics" under the supervision of an assistant chief of bureau who is also Chairman of the Crop Reporting Board. The assistant chief has two principal assistants, one of whom is primarily responsible for the direction of the State offices and the other for the coordination of technical policy and work program.

The activities have been grouped for greater effectiveness under six major divisions, each under the direction of a competent statistician, as follows: Statistics of (1) Field Crops; (2) Fruits and Vegetables; (3) Livestock and poultry; (4) Dairy products; (5) Prices; and (6) Special Farm Statistics.

The present organization of the Bureau is shown on the accompanying chart (Figure 1).

(a) Economic Investigations

1. Economics of Production:

The work in this field includes all the research activities in farm management, farm finance and land economics. This research deals primarily with the most efficient use of labor, land and other resources in agricultural production. Studies are made to determine the most profitable systems of farming in different parts of the country; to measure the changes in income, costs and net returns on farms of different types and sizes by farming areas; and to ascertain the shifts in crop and livestock production that are likely to be most profitable in view of changes in market outlook, costs and other production conditions. Nearly all of this type of work is carried out in cooperation with the Land Grant Colleges. Studies are made of the use of credit in agriculture, of farm taxation and of risk and insurance problems. Land value changes have been studied by States and regions and for the U. S. Annual series go back to 1912. During the war emergency current changes in the land market were studied and reported on. Changes in farm ownership and tenancy, in major uses of land, and ways of improving tenure and land use, are also a part of the research in this field.

## Table I.—Trends in Agriculture and Related Data

Year	Civilian		Farm		Production		Prices farmers		Farmer's		Bil. dol.
	Million	1935-39 = 100	Million dollars	1910-14 = 100	Cents	Share of land	Farmer's	Farmer's	Farmer's		
								</			

1/Including Government payments. 2/Prices received for farm commodities (Aug. 1909-July 1914 = 100). 3/Prices paid for commodities used for living and production, including interest and taxes. 4/Preliminary. 5/March 1 data.







# U.S. DEPARTMENT OF AGRICULTURE

## BUREAU OF AGRICULTURAL ECONOMICS

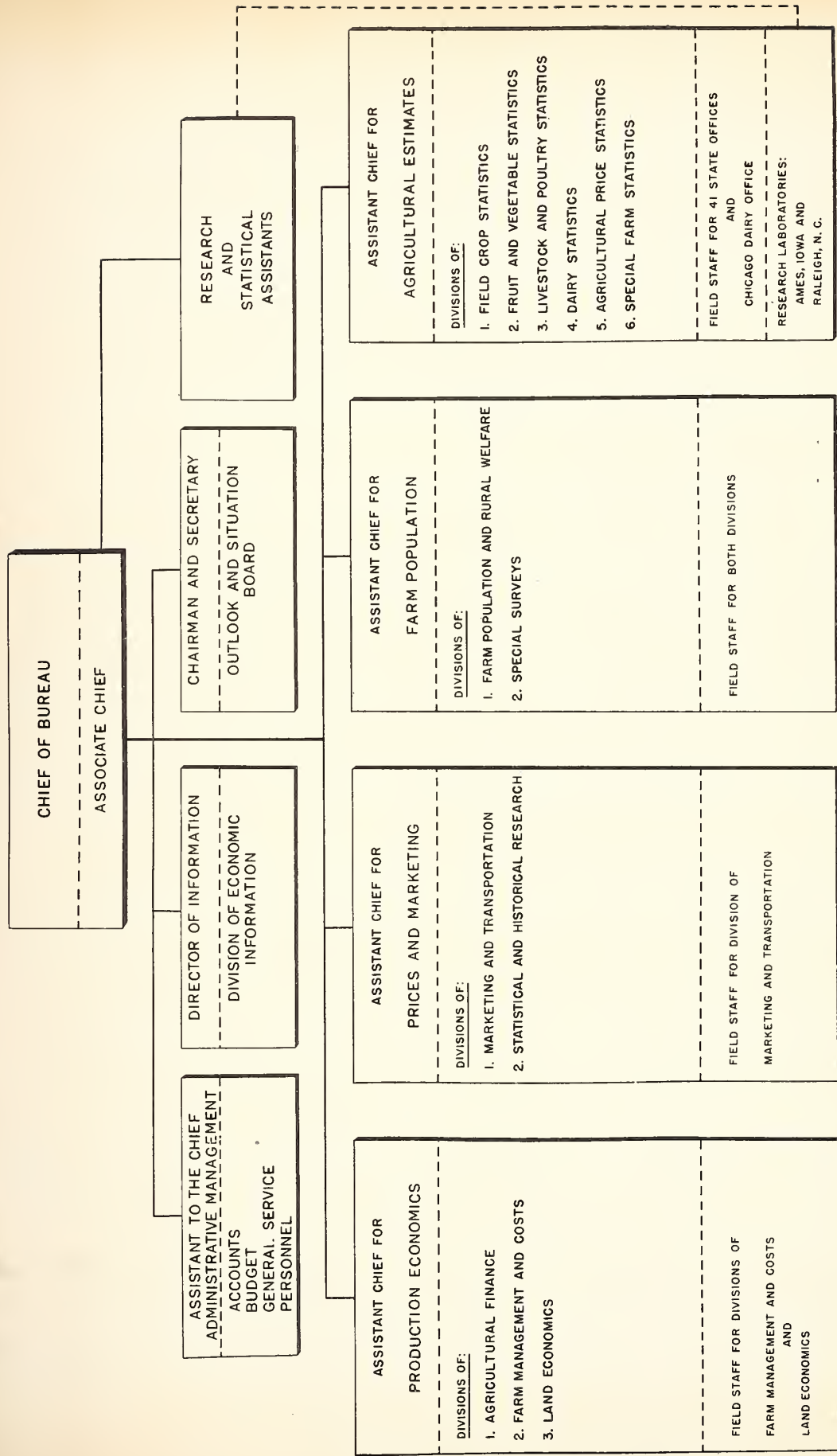


Figure 1



Examples of Progress and Current Programs: Some examples of activities under Project I, "Economics of Production," are shown below:

Changes in Farming: A comprehensive study that was undertaken in order to analyze the changes in farming during the interwar and war years, to appraise the forces back of the large increases in production, and to evaluate some of their peacetime implications was summarized during the past year. The title of this report is "Changes in Farming in War and Peace." This report has been widely commented on by the daily press in different sections of the country as well as by magazines of National circulation. It has been reprinted in part also by trade journals and other publications. Figure 2 (following) shows the annual changes in gross farm production beginning with 1919; also crop production per acre and production per worker. Gross farm production (which includes farm produced power) for the 3 full war years 1942-44 averaged 122 percent of the prewar years 1935-39. The preliminary figure for 1946 is 126 percent. If production is measured in farm output for human use the increase above prewar is even higher, 133 percent in 1946.

What are some of the forces back of this increase in production, and are they likely to continue? It appears that about a fourth of the wartime increase was due to weather conditions more favorable than in prewar years. A small part of the increase (probably less than 15 percent) resulted from some expansion of cropland acreage. (See Figure 3.) The balance of the increase (around 60 percent) is largely accounted for by mechanization, and by crop and livestock improvements. The greatest force in mechanization has been the shift from animal to mechanical power. (See Figure 4.) In crop production one of the principal factors has been the tremendous increase in use of fertilizer and lime. (See Figure 5.) Improvements in strains and crop varieties have also been major factors in pushing up crop production per acre. (See Figure 6.)

The upward trend in livestock production (Figure 7) results both from increased numbers and greater production per animal. The larger feed supply made it possible to feed more animals, but improvements in the quality of feed also contributed to a larger livestock output. The gradual increase in the protein content of the hay supply has helped to balance the rations for cattle and sheep. (See Figure 8.) The wartime increase in oil crops also made available larger quantities of high protein by-product feeds although the supply was not large enough to meet the huge wartime demand.

Most of the forces responsible for the recent upward surge of farm production seem likely to continue to operate in peacetime. With average weather, total farm production therefore seems likely to stay at high levels.

Production Adjustments in Agriculture: Demand for food both at home and abroad still continues at high levels, but farmers are beginning to think of the types of agricultural adjustments that are desirable over the longer pull. Cooperative production adjustment research with the forty-eight States is therefore continuing on the year-by-year work, but special emphasis is being given to developing a background for specific

production outlook work by areas and types of farming within each State. More detailed longer term studies are under way in some areas that are facing special adjustment problems.

As in previous years the forty-eight State reports on suggested adjustments for the year ahead were summarized nationally to provide production outlook information and they were also made available for use in developing and distributing agricultural goals for 1947. Within each State these reports serve as a background for educational and other programs designed to assist farmers in their production plans. As this work progresses, it becomes increasingly clear that farmers need not only a general picture of requirements, or market demand, for the products of American farms, but, much more so, they need these facts interpreted in terms of a production outlook for farms by types, sizes, and locations similar to their own.

Feed-Livestock Balance: Research on the feed-livestock balance has continued during the year. Two reports released in April 1946 were: "Feed Consumed by Livestock, 1941-42, by States" and "The Deficit in Protein for Livestock." The first of these publications brings up-to-date similar work reported in USDA Circular 670, "Feed Consumed by Livestock." Comparisons are given of average rates of feeding each class of livestock by States and the total quantities of feeds consumed. The relative importance of each of our feeds is discussed both nationally and by States and regions. Wide variations are disclosed both in rates of feeding and in types of feeds fed in different parts of the country, as each region attempts to adapt insofar as possible to the feedstuffs produced locally.

In the second publication comparisons are made between the quantities of protein fed to our livestock in 1941-42 and the amounts that would have been desirable as measured by nutrition standards. Our hogs could have been fed 23 percent more protein to advantage; poultry, 14 percent; beef cattle, 12 percent; and dairy cattle, 5 percent. The study indicates that the protein balance varies tremendously for different parts of the country. A demand for high protein concentrate feeds has been created that may be hard to fill in postwar years. But the relationship between prices of purchased feeds and of livestock returns will influence future rates of protein feeding, particularly in areas of deficit feed production.

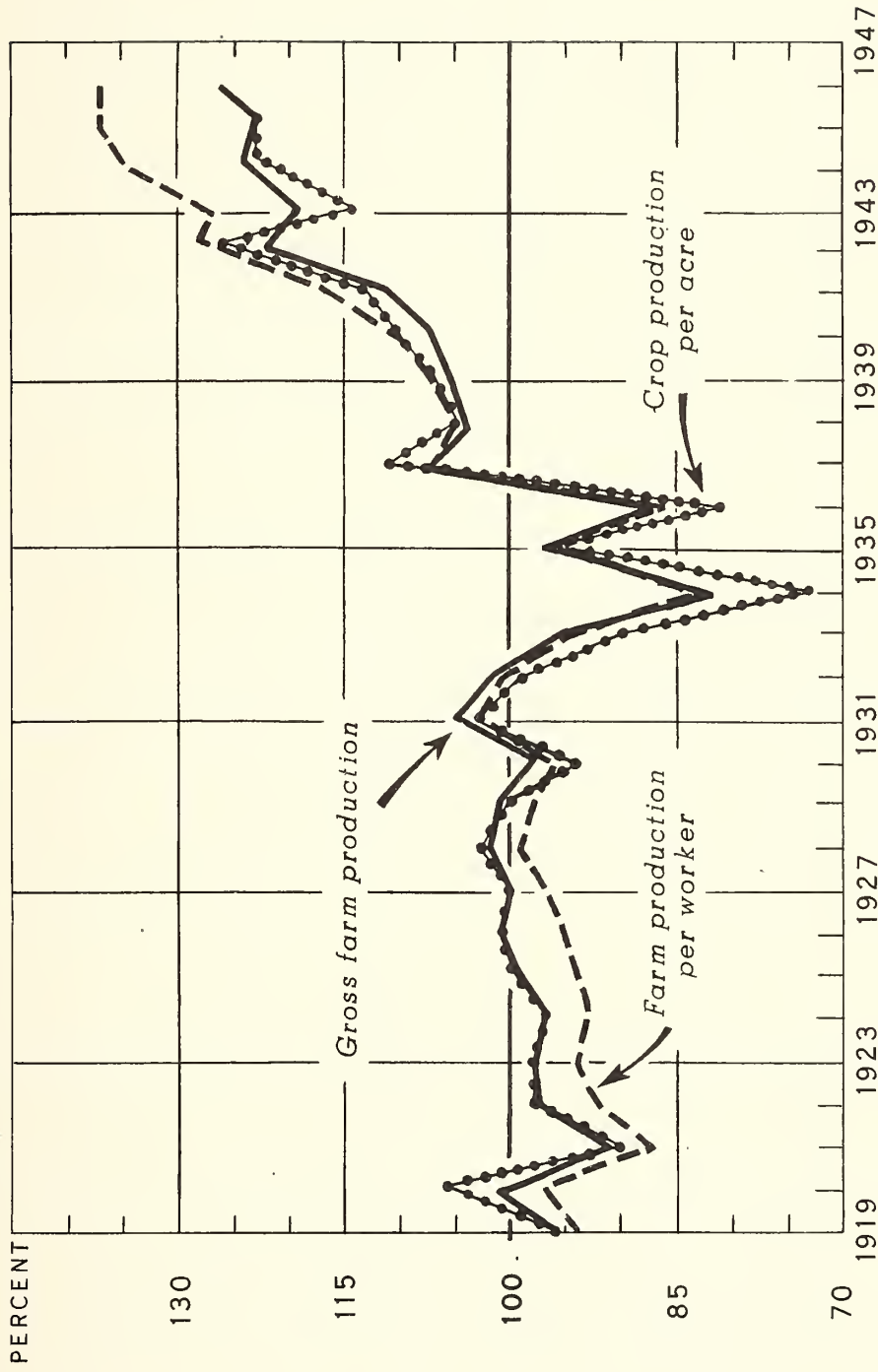
Farm Costs and Returns: General conditions of prosperity or of adversity are felt with varying degrees of intensity from farm to farm and from one locality to another. Operators of large commercial family farms of a given type may be in a position to take advantage of new practices, new machines, new varieties of crops, volume purchases of production supplies, and many other means of increasing production or reducing costs to widen the margin of profit. Smaller farms of the same type may not as readily make these changes, and their output may be so small that even wartime prices are insufficient to yield a satisfactory income.

Information concerning the specific conditions under which farming is carried on is needed as a basis for measuring the effects of changing conditions on net returns to different groups of farmers. Although each farm has its own characteristics, farms of similar types and sizes and



# GROSS FARM PRODUCTION PER WORKER, AND CROP PRODUCTION PER ACRE, UNITED STATES, 1919-46

INDEX NUMBERS, ( 1935 - 39 = 100 )



U. S. DEPARTMENT OF AGRICULTURE

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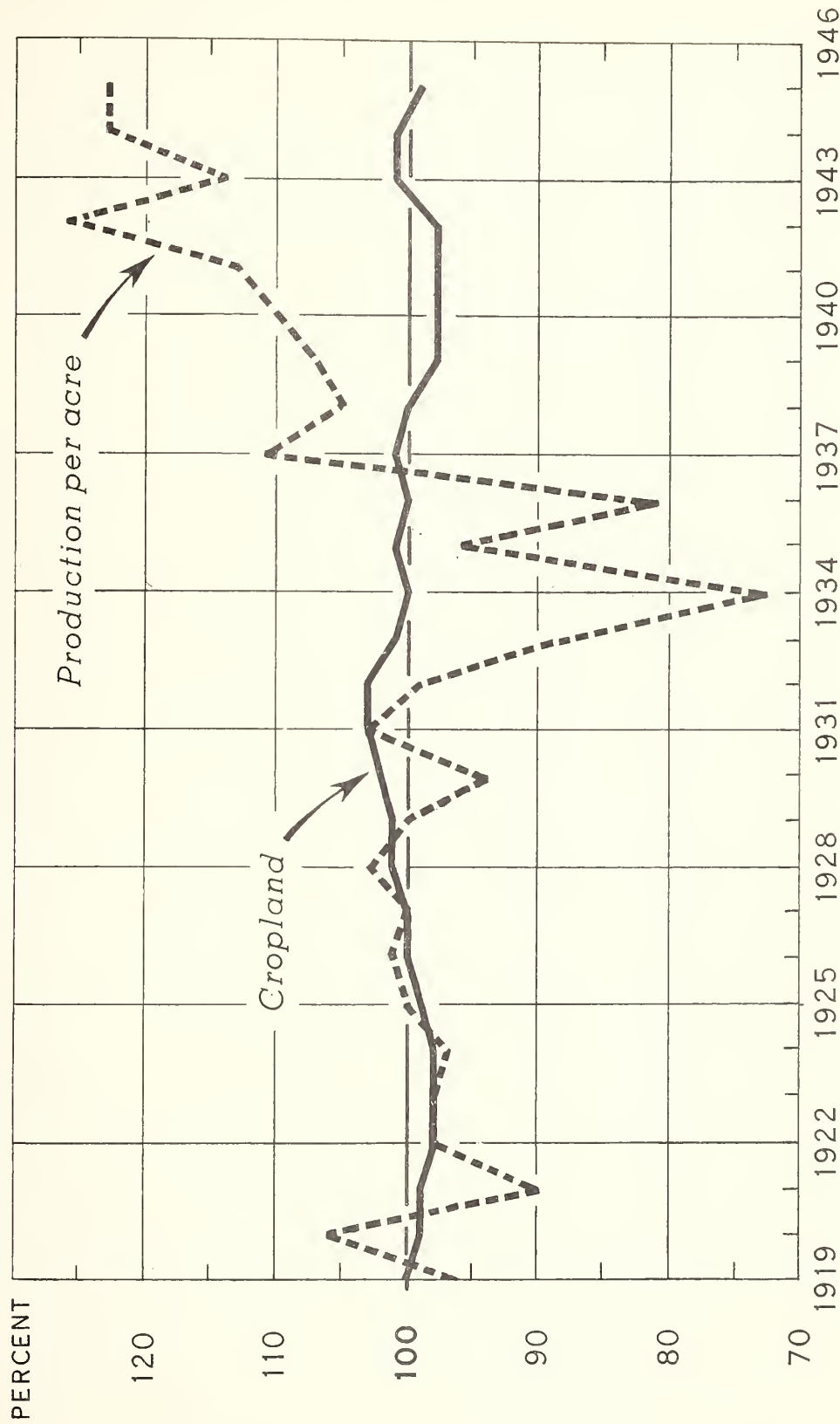
BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 2



# TOTAL CROPLAND, AND CROP PRODUCTION PER ACRE, UNITED STATES, 1919-45\*

INDEX NUMBERS (1935-39=100)



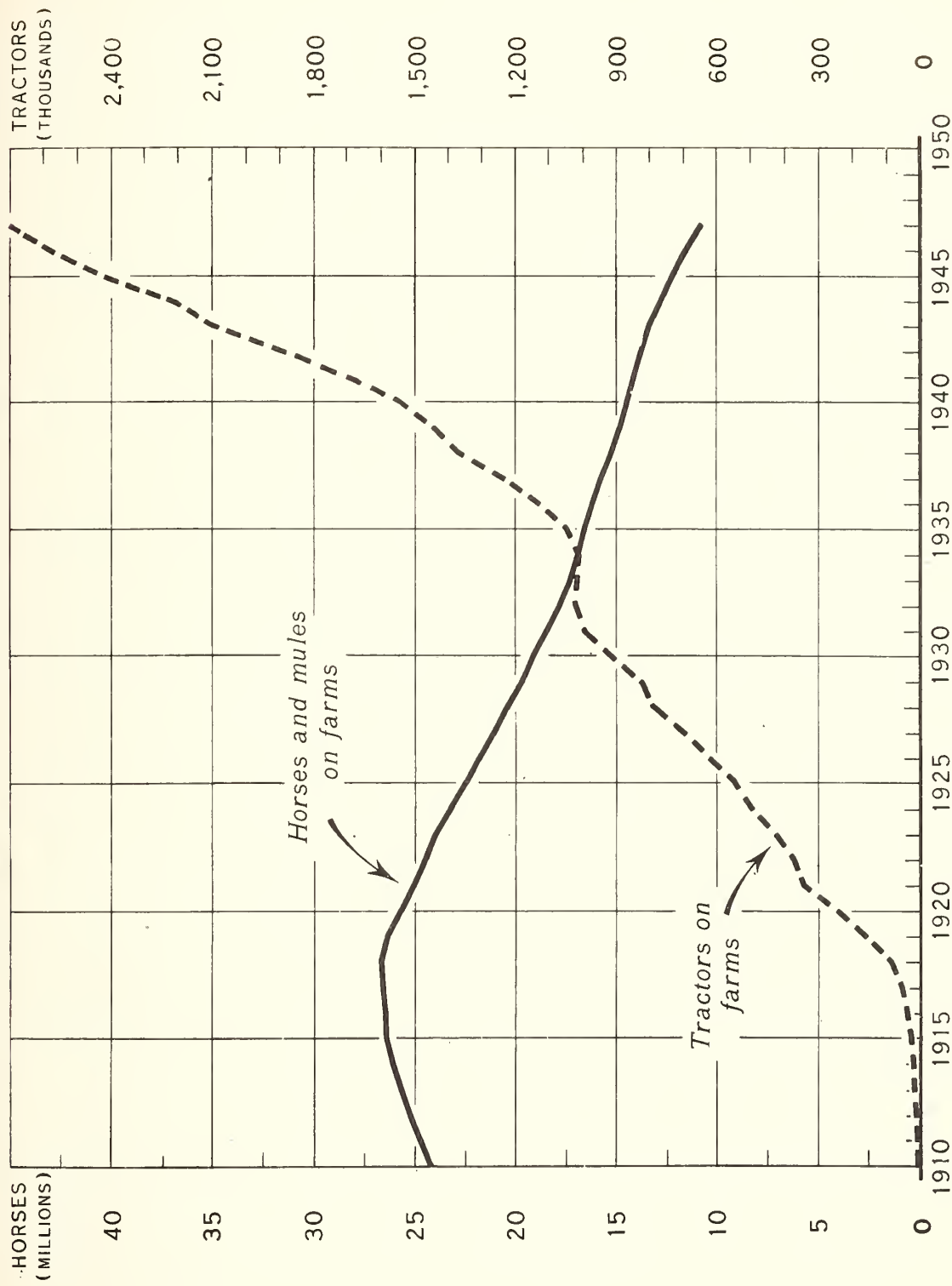
DATA FOR 1944 AND 1945 ARE PRELIMINARY

\* TOTAL CROPLAND IS THE SUM OF THE ESTIMATED ACREAGE OF LAND FROM WHICH ONE OR MORE CROPS WERE HARVESTED PLUS ESTIMATED CROP FAILURE AND SUMMER FALLOW ACREAGE.





# HORSES AND MULES, AND TRACTORS ON FARMS JANUARY 1, UNITED STATES, 1910-47

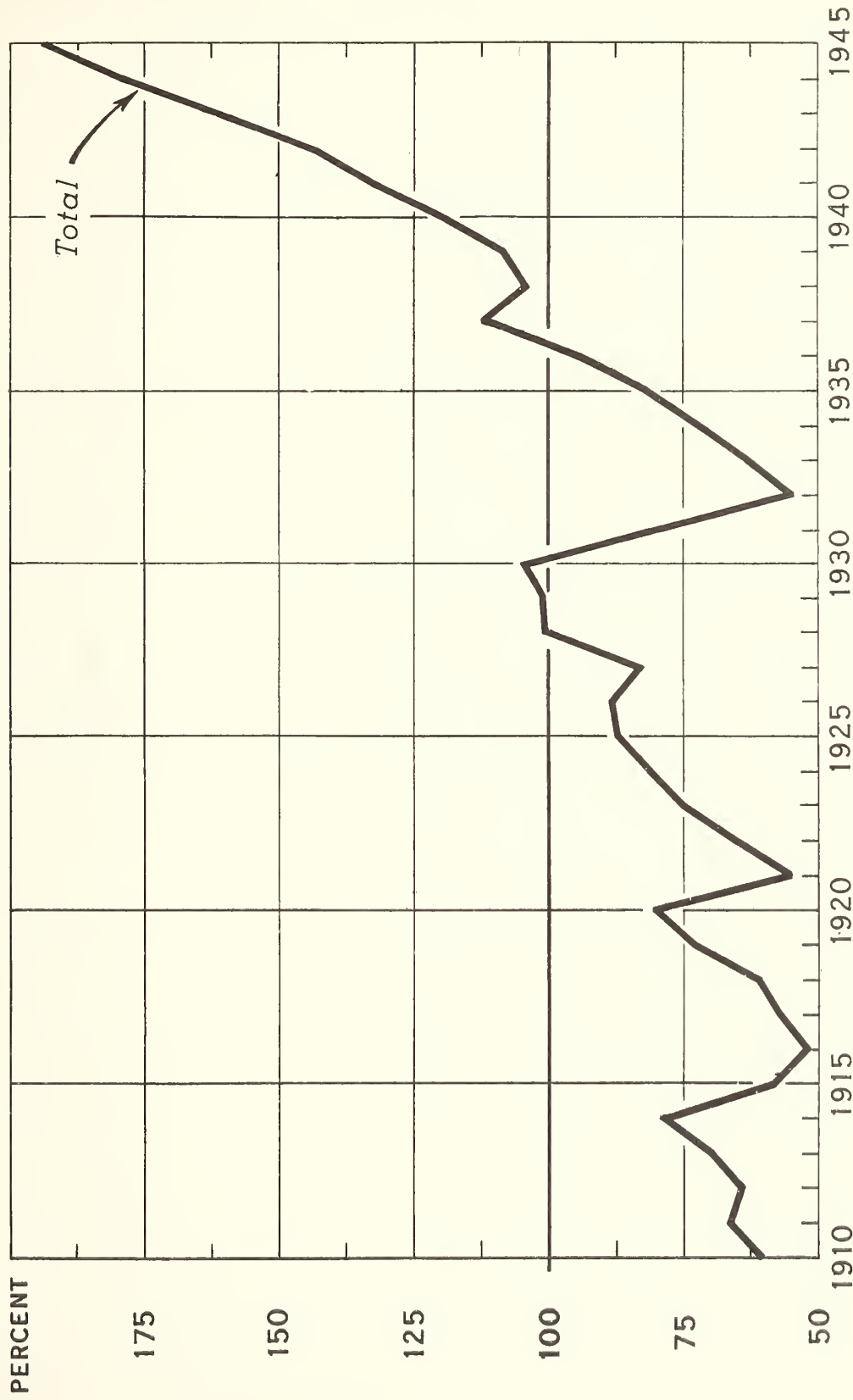


1945 TRACTOR NUMBERS FROM PRELIMINARY CENSUS REPORT, 1941-44 DATA ARE REVISED ESTIMATES OF BAE ADJUSTED TO PRELIMINARY CENSUS NUMBERS, 1946 AND 1947 ARE PRELIMINARY ESTIMATES



# FERTILIZER CONSUMPTION IN TERMS OF NITROGEN, PHOSPHORIC ACID, AND POTASH, CONTINENTAL UNITED STATES, 1910-45 \*

INDEX NUMBERS (1935-39=100)



\* COMPUTED FROM DATA SUPPLIED BY P. I. S. A. E., A. A. A. AND T. V. A.  
DATA FOR 1945 ARE ESTIMATED





# PERCENTAGE OF CORN ACREAGE PLANTED WITH HYBRID SEED, NORTH CENTRAL STATES AND UNITED STATES, 1933-46

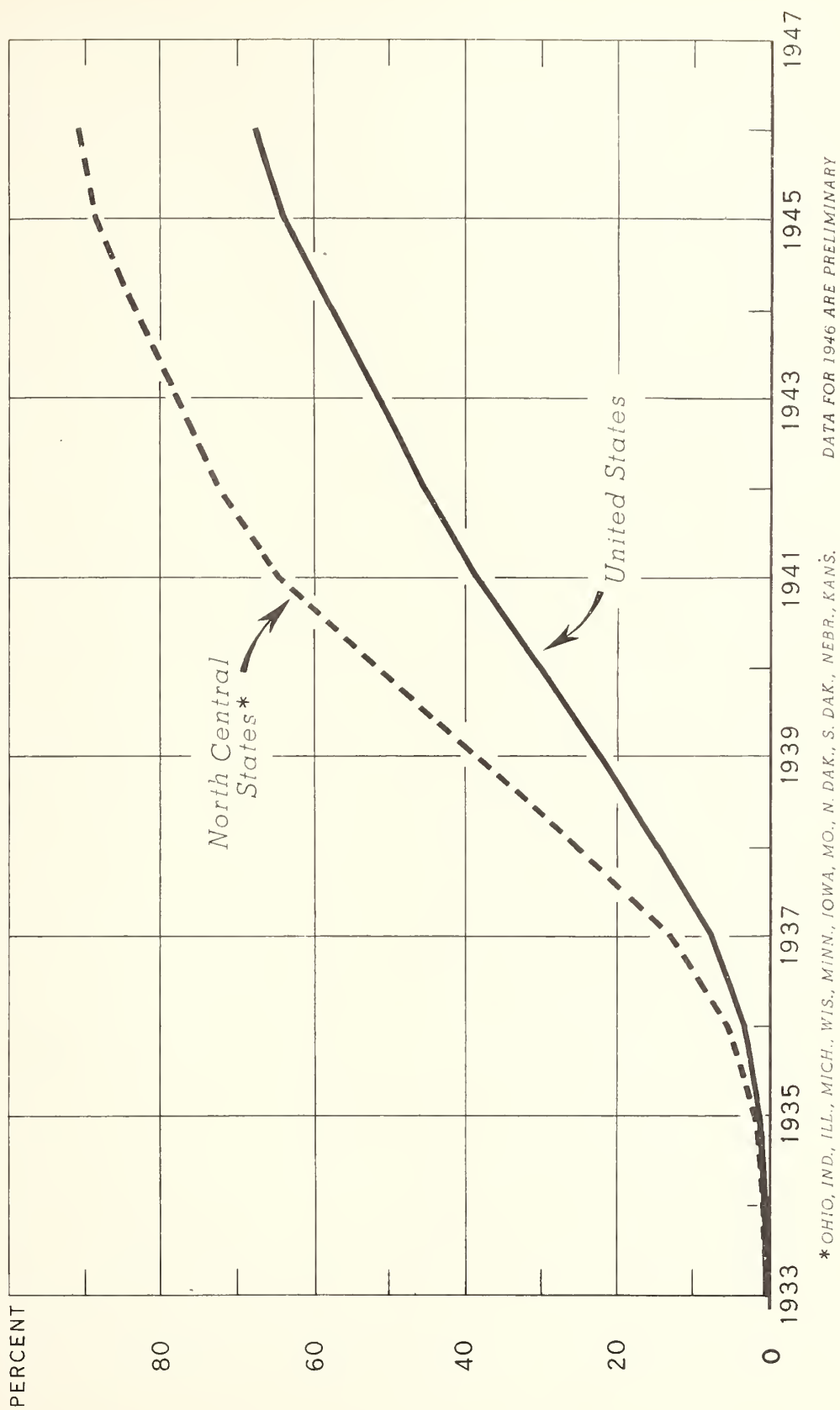
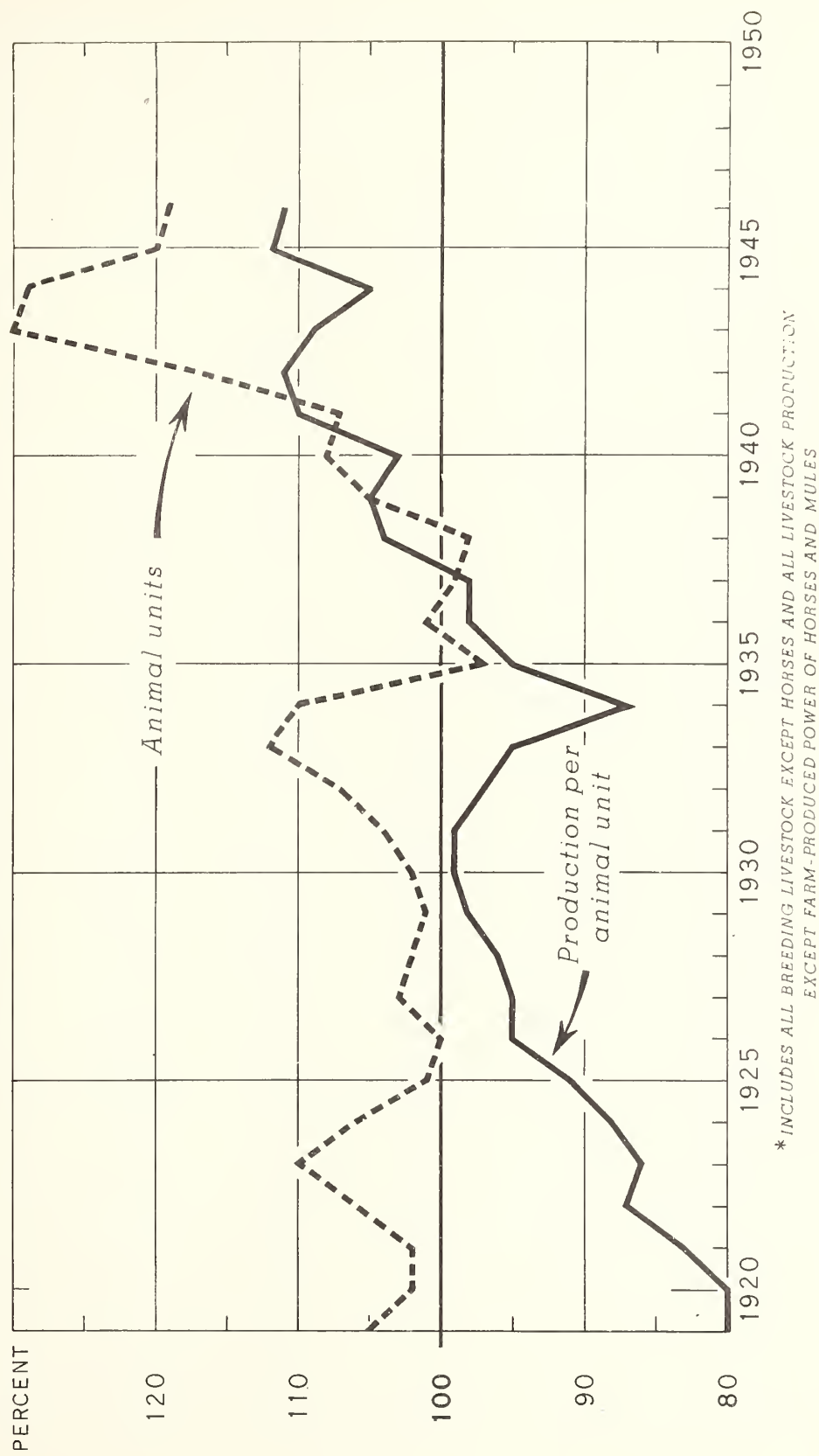


FIGURE 6



# ANIMAL UNITS OF BREEDING LIVESTOCK AND LIVESTOCK PRODUCTION PER BREEDING UNIT, 1919-46\*

INDEX NUMBERS (1935-39=100)

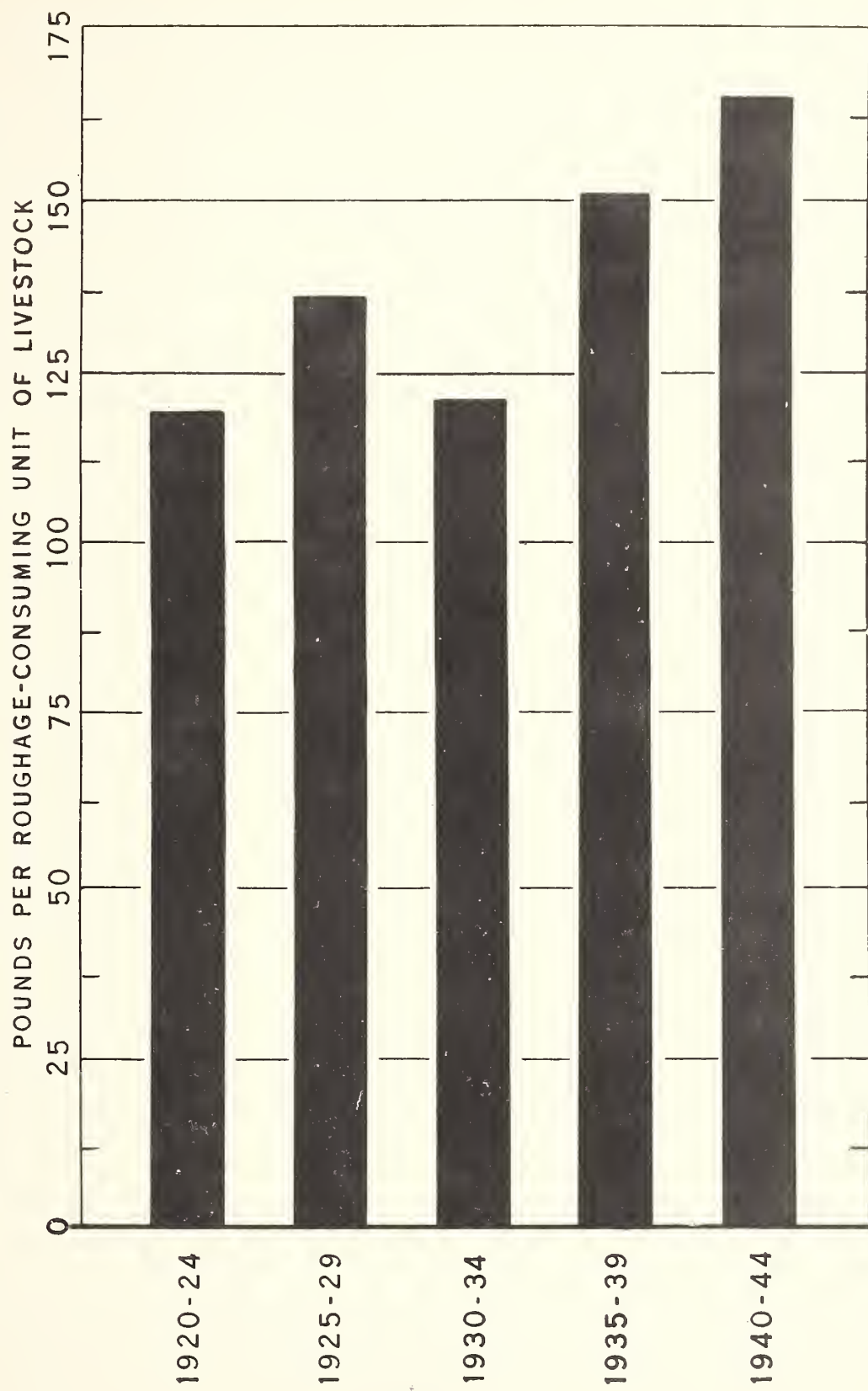


\* INCLUDES ALL BREEDING LIVESTOCK EXCEPT HORSES AND ALL LIVESTOCK PRODUCTION EXCEPT FARM-PRODUCED POWER OF HORSES AND MULES





# DIGESTIBLE PROTEIN AVAILABLE IN ALL HAY, UNITED STATES, 1920-44



U. S. DEPARTMENT OF AGRICULTURE

FIGURE 8

NEG. 45091 BUREAU OF AGRICULTURAL ECONOMICS



operating under similar physical conditions are likely to respond in about the same way to changes in farm prices, costs, and other economic conditions. Thus by studying in detail the results on farms representative of the more important of these broadly similar groups we gain the understanding needed regarding the effect of changing economic conditions on income, costs and net returns from farming.

The Bureau is now studying 26 of the more important representative farming situations in the United States, but a more complete coverage is needed. Two publications were released in April 1946 reporting on 14 of these situations for each year of the period 1930-45. One is a brief nontechnical report. The other presents a detailed picture of each farm situation. It shows gross and net farm income for each year; (See Figure 9); also the varying significance of the different income and expense items through the years, the farmer's progress in paying for his farm and the yearly return to the operator's labor and management.

These series also provide a basis for calculation of various types of farm production costs and make it possible for the Bureau to add a new report to its periodic "situation" series - "The Farm Cost Situation." The 1947 Outlook issue deals with the prospective availability of farm labor, machinery, and other resources for use in farm production in 1947 and presents past trends and future tendencies in the prices of cost items. Other issues of this publication will carry the year-by-year indexes of costs and returns for the representative farming situations under continuous study.

Farm Real Estate Values: Current study of developments in the farm real estate market has been continued throughout the year. Farm real estate values rose 14 percent during the year ended November 1, 1946. This rise brings the index of values for the country as a whole to a level that is 83 percent above the 1935-39 average and 52 percent above 1912-14. (See Figure 10.) The increases since the 1935-39 period have exceeded those of the 1912-14 to 1920 period, and values are still advancing. The current level of values, however, is still about one-tenth below the 1920 inflationary peak because the pre-War II levels were about 15 percent below those of pre-War I.

Accompanying these rapid value increases has been a high volume of sales and an increase in the frequency of resales after a short period of ownership. Although a large proportion of the sales have not involved a farm mortgage, heavy debts have been incurred on a significant number of credit financed sales. For the country as a whole a debt of 56 percent of the present sale value would be about equal to the full value of the land in 1941.

The data on the land market are obtained primarily from crop reporters, farm real estate dealers, and quarterly surveys in about 130 selected counties distributed throughout the country. Brief national reports covering current conditions were released each 4-month period, with yearly trends and movements treated in more detail in the annual "Farm Real Estate Situation" report. The work involved in collecting data from selected counties has been carried on in cooperation with about 20 Land Grant Colleges and a number of cooperative State publications have been prepared.

Widespread use has been made of these periodic land market reports and analyses. Lending agencies and individual buyers, sellers, borrowers and lenders have indicated an increasing interest in current information on changes in land values, the volume of sales, types of buyers and sellers, frequency of resales, rental returns and their relation to values and other related data. The reports have been used extensively by newspapers, farm journals, extension workers, college teachers and others. Largely through the use of material prepared by the Bureau, farmers and others are much better informed on current developments than was the case during World War I.

Land Ownership and Farm Tenancy: Few facts are available on who owns the Nation's land and how land is acquired and transferred. To help supply the needed facts on present land ownership, on how farmers have acquired ownership of land, and how farmer ownership might be facilitated a land ownership questionnaire was developed to supplement the information from the 1945 census. Questionnaires were sent to a sample of landowners in every county in the Nation. An unexpectedly large number of landowners cooperated in the survey by returning the information requested. Analysis of these replies will show (1) the number of farms and acres owned by individuals, corporations and other types of owners, (2) the manner in which land is owned, such as purchase contracts, partnerships, life estates, undivided interests and fee simple estates, (3) how farms are acquired such as inheritance, gift, purchase and foreclosure, and (4) practices whereby owners are transferring land from one generation to the next. Twenty-five Land Grant Colleges are cooperating in the survey by helping to obtain, analyze and interpret information submitted by landowners. Results will be summarized in a national report, "Ownership of the Nation's Farms," and two regional reports, one for the North and one for the South prepared in cooperation with the respective Land Grant Colleges. Since about one-third of the Nation's land remains in public ownership, a supplemental survey is designed to find out how much land is in Federal, State and local governmental ownership and the use being made of this land such as forests, grazing and recreation.

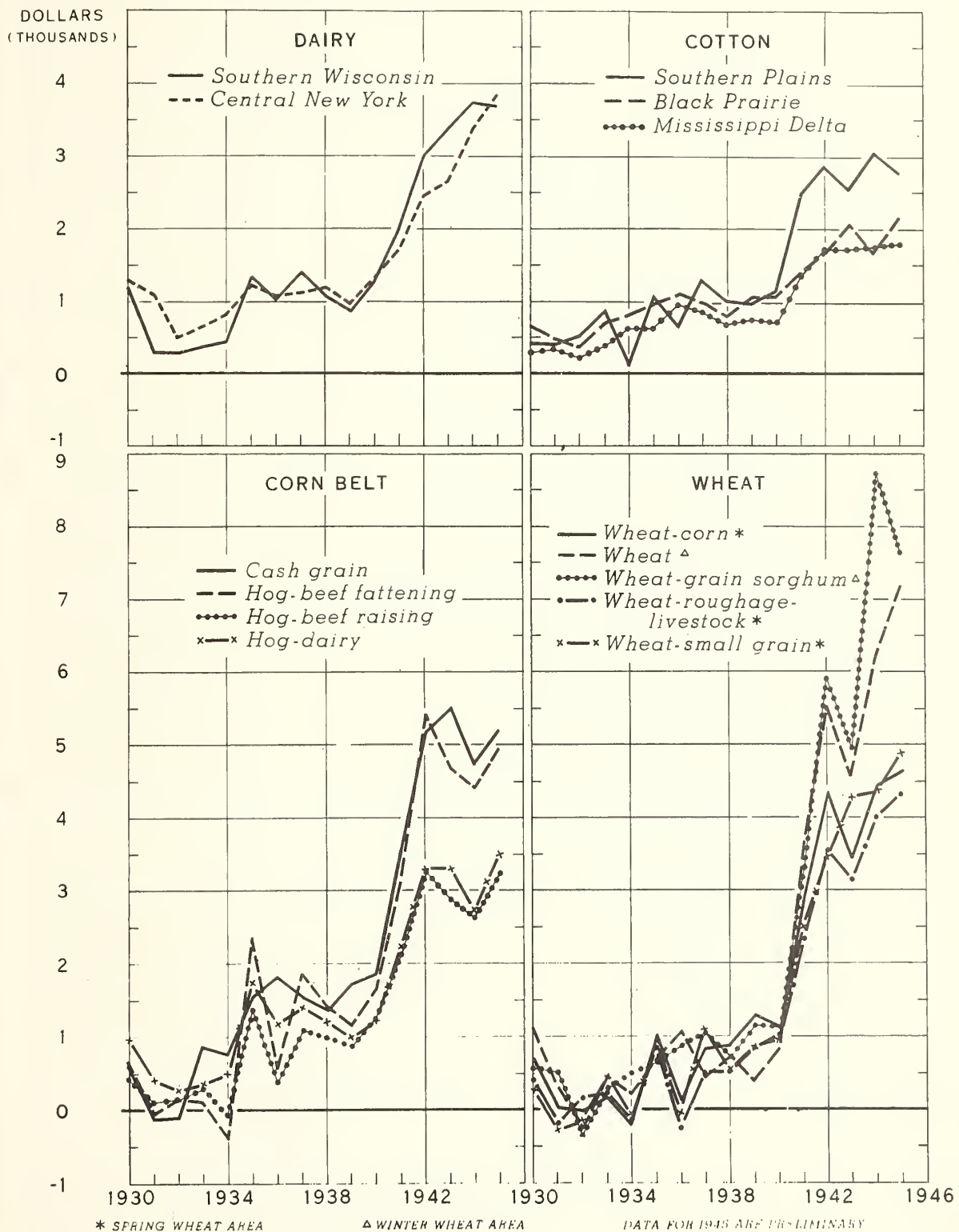
Although the general ownership situation can be depicted through mail and census surveys, other information of a more detailed nature is needed to supply individual landowners with information on alternative ways of transferring their land from one generation to the next without acquiring heavy mortgage indebtedness, without breaking up the "going concern" organization of the family farm or dividing up the land among several heirs into uneconomic farm units. To supply this information, intensive studies are being made in cooperation with State Experiment Stations including Michigan, Wisconsin, Virginia, and South Carolina, to find out from landowners how they have overcome problems in acquiring and maintaining ownership of their land. Experiences of these owners are being analyzed, and reported on, in State and U.S.D.A. bulletins.

Preliminary analyses indicate a decrease in the proportion of farms operated by tenants from 38 percent in 1940 to 34 percent in 1945. Work is under way on a Graphic Summary of Farm Tenure and a report on Farmer's Equities in Their Land Holdings. In addition, a more analytical report, "Tenure Changes During the War," summarizing significant information from



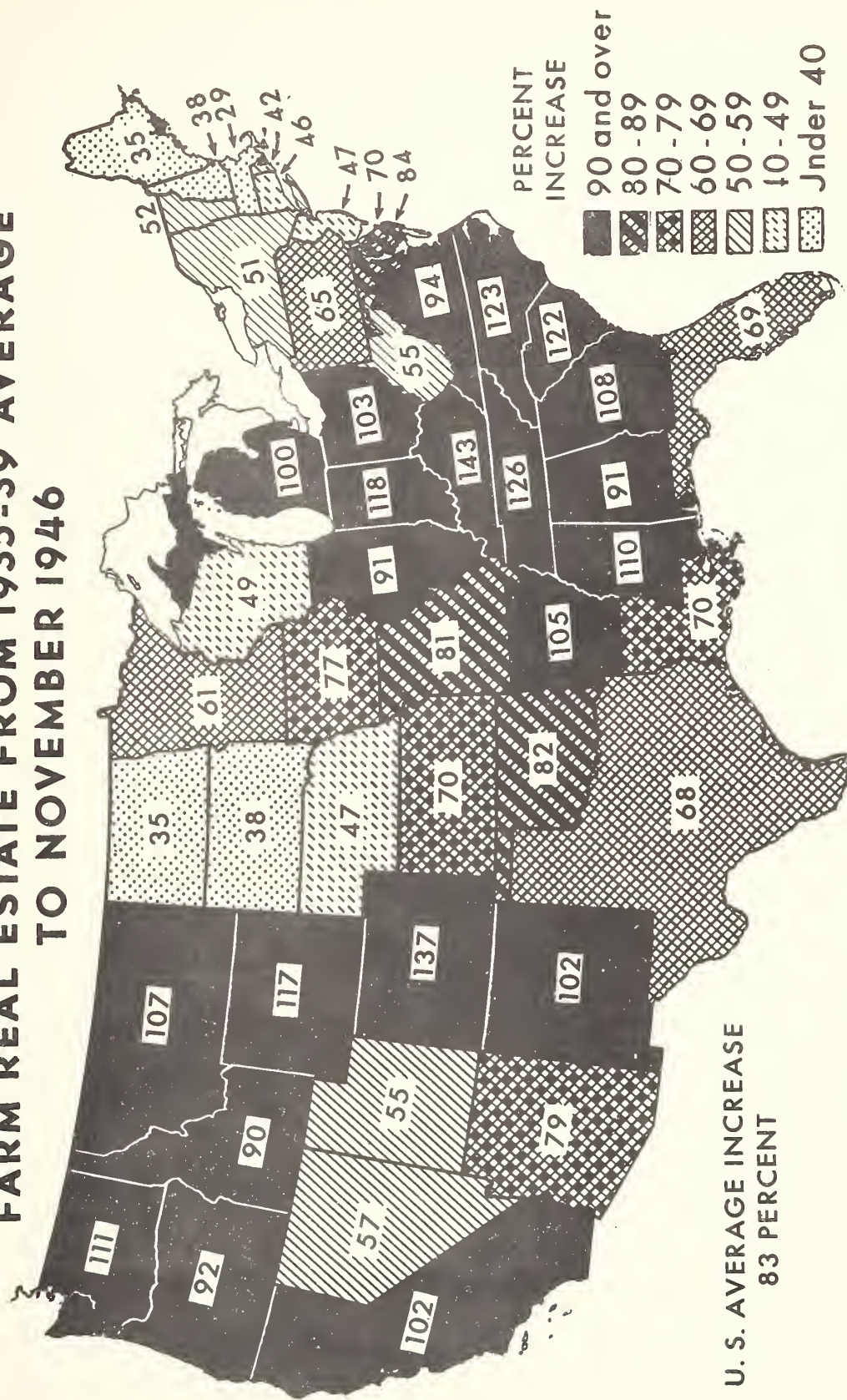
# FARM EARNINGS

## OPERATOR'S NET FARM INCOME, TYPICAL FAMILY-OPERATED FARMS, BY TYPE, 1930-45





# PERCENTAGE CHANGE IN AVERAGE VALUE PER ACRE OF FARM REAL ESTATE FROM 1935-39 AVERAGE TO NOVEMBER 1946







studies made during the war years as well as the 1940 and 1945 censuses is being prepared. Work on landlord-tenant relations is being continued. The Bureau also participates actively in the work of the regional land tenure research committees, involving cooperative work with 29 Land Grant Colleges.

Land and Water Utilization: An investigation is under way that is designed to provide an inventory of the Nation's land resources by types of major uses and ownership. This inventory is expected to indicate the present land use situation, trends in major uses, and future use potentialities. Preliminary results indicate that in 1945 over one-third of the land area of the Nation was used chiefly for grazing; one-third was forested, much of which was devoted to grazing and other multiple uses; one-fourth was used for crops; 6 percent was occupied by urban, residential, park service areas, and other related uses; and 4 percent was other land, chiefly in desert, dunes, swamps, rock, and wasteland. (See Figure 11.)

The principal changes in major uses that occurred during the war include some increase in crop acreage through plowing pastures and planting acres that formerly were fallow or idle, and a reduction in the merchantable timber acreage. The amount of new land developed for farming was not sufficient to balance the poor crop and open pasture land allowed to revert to woodland. More detailed and complete periodic estimates and analyses of this type are needed to supplement data on land in farms in order to get a more complete picture of the agriculture industry as well as of the total land resources of the Nation.

In order to meet the continuing inquiries from returning veterans and other people interested in farming, the Bureau has followed up previous work on land settlement by assembly and publication of current information on farming opportunities and experience. Reports issued on Farming Opportunities show that there are about 160,000 to 175,000 openings for new farm operators per year. These openings result from farmer retirements, changes to other jobs, deaths, and by the development of 10,000 to 15,000 new farms per year. The study shows that the new farming opportunities are largely on existing farms and are rather uniformly distributed over all the chief agricultural areas. The new farms being developed are located principally in the areas recently given flood protection and drainage in the South and new irrigation enterprises in the West and in other scattered areas. A significant fact is that new land well suited to farm development without construction of major public works, such as drainage, flood control or irrigation is now limited in amount. Both the largest number and the best available farming opportunities for new operators are the vacancies occurring on existing developed farms. Data on farming opportunities have been collected in cooperation with State Agricultural Experiment Stations and other public agencies.

Facts on farming opportunities, land development, settlement experiences, ways of getting started in farming and planning of the farm business are in great demand by both public and private agencies and by individuals. They must be kept current to be the most valuable. Banks and other farm-lending agencies, educational institutions, newspapers and farm journals, veterans, farmers and prospective buyers and sellers of farm land have

made extensive use of Bureau publications along these lines. For example, it has been necessary to make two reprints of Farmers' Bulletin 1961, "Getting Started in Farming," and 162,000 copies have been made available. It has been necessary to make available 110,000 copies of Farmers' Bulletin 1965, "Planning the Farm for Profit and Stability."

Credit Studies: Benchmark estimates of farm-mortgage debt, interest rates on outstanding mortgages, proportion of farms under mortgage, and distribution of mortgage loans by principal lenders are being developed on the basis of sample data gathered in cooperation with the Bureau of the Census. These estimates are made by States every five years to supplement the Census tabulations which cover owner-operated farms only, and to provide a basis for checking annual estimates carried forward from Census years on the basis of data for major institutional lenders and other supplemental information.

With only one minor exception the farm-mortgage debt has shown a continuous although somewhat erratic decline for the past 23 years. On July 1, 1946, however, there was evidence of a turning point. On that date the farm-mortgage debt is estimated to have been 80 million dollars more than at the beginning of the year when it amounted to 5,081 million dollars. This latter figure was the lowest level of indebtedness since 1915 and was less than half the peak reached at the beginning of 1923. The mortgage debt declined by 23 percent during the war years 1940-46 as shown in figure 12. This was in sharp contrast with developments in World War I (1915-19) when the debt increased 43 percent.

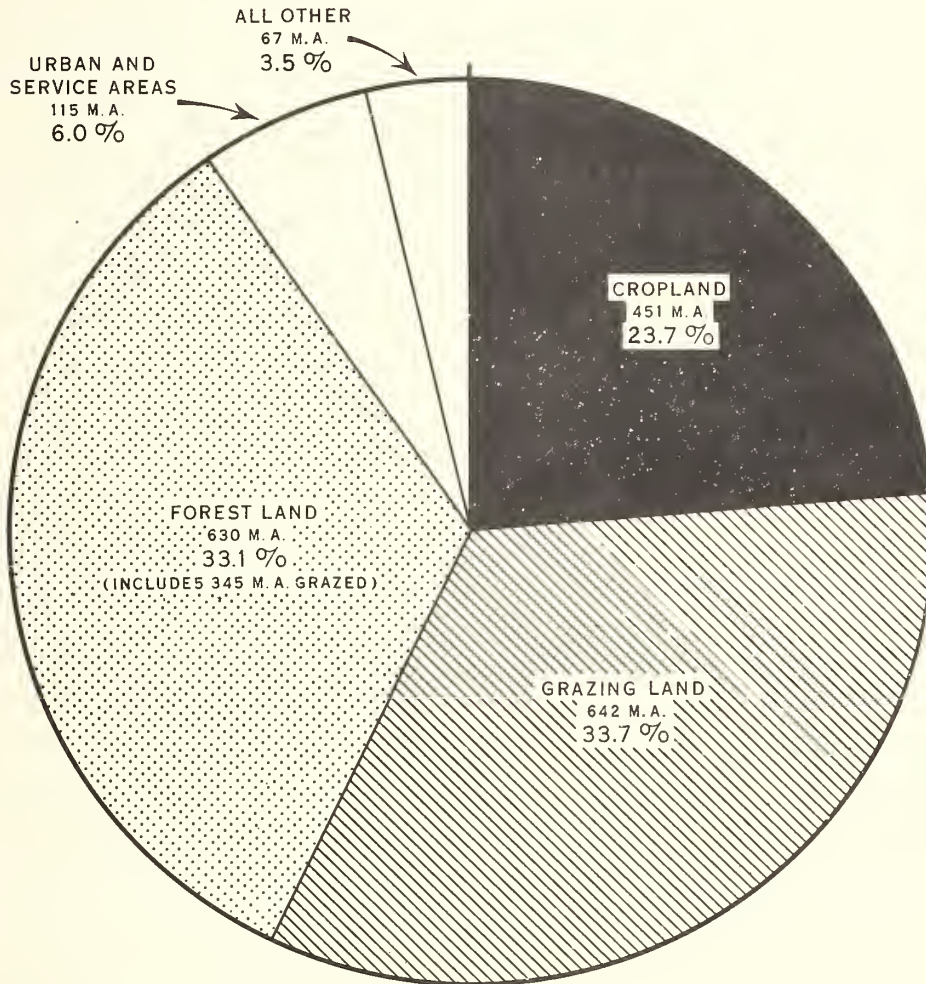
In the last 6 months the debt held by major lenders has increased for commercial banks, individuals and other miscellaneous lenders; and there has been a distinct slowing up in the rate of decline for the Federal agencies and life insurance companies. In the early 1920's, a marked increase in loans held by commercial banks and individuals was an important factor in the sharp increase in total debt. In view of current developments and past experience, data on these holdings take on added significance as a basis for appraising possible future debt difficulties for farmers.

During the first half of 1946 a strong upward tendency appeared in the loans of the principal lending agencies to farmers for production and other short-term purposes (excluding loans held or guaranteed by the CCC). This was particularly noticeable in the Middle Atlantic, East North Central, South Central, and Pacific States. In the country as a whole the increase was about 400 million dollars. This is twice as large as the average seasonal increase in such loans from January 1 to July 1 during the war years.

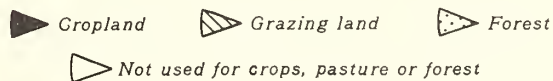
Information on farm debt is widely used: By farmers; by public and private lending agencies extending credit directly to farmers; by the Federal reserve banks in shaping credit and educational policies; by organizations such as the American Bankers Association in their educational programs for rural banks; by the Treasury Department in the development of rural savings bond sales program; and by the Land Grant Colleges in their research and extension programs for farmers and rural lenders. Within the

# MAJOR USES OF LAND IN THE UNITED STATES

1945



TOTAL=1.905 MILLION ACRES



M. A. = Million acres

PERCENTAGES ARE OF TOTAL LAND AREA OF THE NATION

PRELIMINARY-SUBJECT TO REVISION

U. S. DEPARTMENT OF AGRICULTURE

NEG. 46106 BUREAU OF AGRICULTURAL ECONOMICS

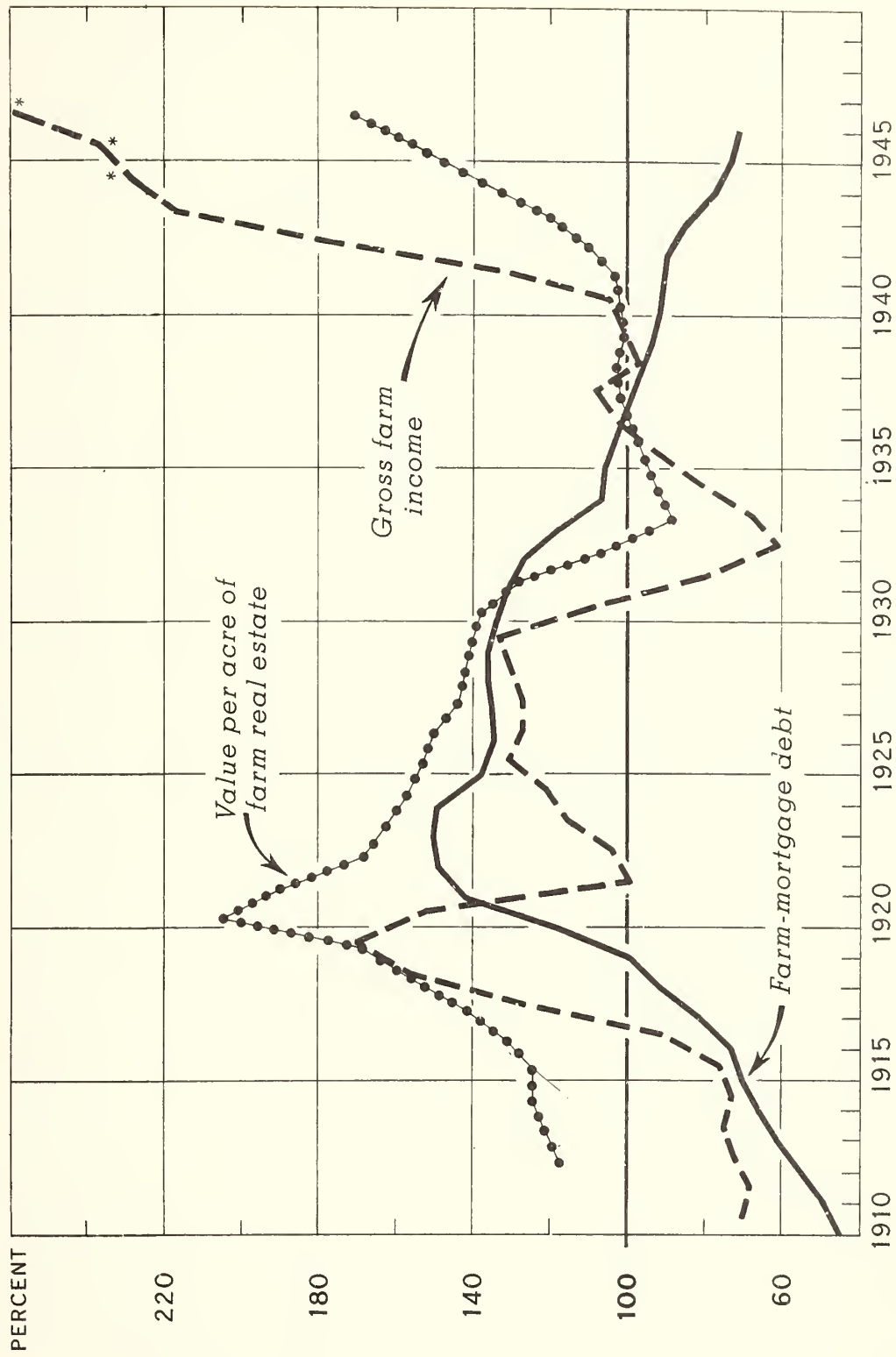
FIGURE II





# FARM-MORTGAGE DEBT, 1910-46; VALUE PER ACRE OF FARM REAL ESTATE, 1912-46; AND GROSS FARM INCOME, 1910-46: UNITED STATES

INDEX NUMBERS (1935-39=100)



\* PRELIMINARY



Department of Agriculture the information on farm debt is used in computing interest charges paid by farmers, which, together with other farm costs, are used in computing the parity prices of farm products. As these data are among the more important indicators of the financial situation of farmers in different areas, current data will be of increasing importance in the readjustment period ahead.

The Annual Balance Sheet: The annual balance sheet of agriculture was carried forward to January 1, 1946. There was a further rise of 3.8 billion dollars in the financial assets held by persons living on farms to over 20 billion dollars on that date. (These assets include bank deposits, currency, and U. S. Bonds.) The limited data available indicate a high degree of concentration, rather than wide distribution, of bank deposits and war bonds. The net change in farmers' debts in 1945 was very small, so that the increase in financial and other assets was reflected in a corresponding increase in net worth of the owners of the agricultural industry.

The increase in the inventory value of physical assets during 1945 of 6.8 billion dollars was largely the result of higher prices. Of this increase 6.3 billion dollars or more than nine-tenths may be attributed to the increase in per acre land valuations. The number of livestock on farms actually decreased during the year, but higher prices more than offset this decline causing inventory values to rise 796 million dollars. Higher prices are also responsible entirely for a 43 million dollar rise in farm machinery inventory. Crops on hand declined both in volume and in inventory value, the decrease in value being 418 million dollars.

The annual balance sheet of agriculture has been used by Land Grant Colleges and farm organizations. It has been reproduced or quoted in numerous publications such as farm papers, the Federal Reserve Bulletin, and leaflets issued by the American Bankers Association. The U. S. Treasury Department has used it as a basic source of information for organizing its campaign to sell savings bonds among farmers. The Land Grant Colleges have requested break-downs by States to show the financial condition of farmers in various parts of the country.

Farm Taxes: Farm real estate tax levies per acre in 1945 were more than 10 percent higher than those of the preceding year. Preliminary indications are that the 1946 levies will show a further increase, possibly about as much as that in the previous year. Together, these two increases reflect the first major change in the trend of these levies in more than a decade. Federal income tax payments by farmers apparently exceeded tax payments on farm property during the past year. Continued study is being made of possible methods for improving the estimates of these and other taxes paid by farmers. In cooperation with the Land Grant Colleges, information was made available to farmers to help them comply with Federal income tax requirements.

Risk and Insurance: A study of life insurance plans suitable for the needs of farm families has been completed. The problems of some 1,900 farmers' mutual fire insurance companies have been studied over a period of years, and annual information on the volume of insurance in force, losses, and expenses are published. These summaries give local farm insurance companies

and their State associations a basis for improving their services and lowering their cost to farmers. Annual estimates of the national farm fire loss are prepared. These are utilized by the National Fire Protection Association and other groups interested in reducing farm fire losses. Progress has also been made on a study of organized farm fire protection in order to assist farmers in developing means of reducing the annual losses from farm fires. The latter study deals with the methods of operation of the organized fire protective groups, laws, costs, and means of financing. The Farm Fire Protection Committee, National Fire Protection Association, and the Agricultural Committee of the National Fire Waste Council are intensely interested in ascertaining the situation with regard to organized farm fire protection in the United States. More adequate protection will reduce losses by individual farmers, and should result in lower premiums.

Plans have been completed for gathering information on the number of farm accidents, their causes, and the loss of life and time involved. Lack of adequate information of this kind has handicapped the States and the Federal Government in their efforts to help farmers reduce the present high rate of accidents in agriculture.

An exploratory study of risks in agricultural production has been started in which an appraisal will be made of the various risk elements of both a personal and business nature in agriculture. Risks of industry generally are insured, whereas the risks of farming usually are carried by the individual farmer, either because insurance is not available, or because the premium charged seems disproportionate to the protection afforded. In this study efforts will be made to ascertain the costs of such risks and how they may be dealt with through insurance or other ways of reducing heavy losses.

Special Studies, Chiefly Field Surveys to Determine Farmers' Views with Respect to Factors Affecting Production: Surveys are made to discover the underlying factors that influence farmers' intentions and behavior in their production and marketing activities. They are designed to show not only the influence of prices but to discover possible other factors, about which little is now known, that influence production response, and to measure the extent of the various factors that influence production and marketing activities.

## 2. Prices, Income and Marketing:

The work under this project covers research on demand, supply and price relationships; factors affecting the consumption and general utilization of agricultural products; the economics of marketing; and transportation problems of agriculture.

Since its organization in 1922, the Bureau has maintained a statistical and economic research service for agriculture. The most significant data needed in analyses have been collected from all available sources. The techniques of analysis have been developed to determine what forces or factors are important in the demand for farm products, and what prices are likely to be realized for the quantities produced. Many of the important farm products have been subjected to such an analysis.



Because general economic conditions are important in determining prices for the several farm products and the cost of what farmers use in production, analysis has been directed toward measuring changes in general economic conditions and the relationship of those changes to changes in the demand for farm products. This often involves the use and analytic adjustment of statistical series collected by other agencies, series that measure business activity and incomes of consumers of farm products. Questions arising as to the position of the farmer in the national economy have led to the development of measures to compare the prices farmers get with the prices they pay, and to compare the incomes of farm and non-farm people.

In view of the dependence of farmers upon prices to determine their incomes, a national outlook service was developed in cooperation with the Extension Service which, in large part, is based upon the analytical research relating to prices and income. This service is intended to give farmers the best possible appraisal of both the demand and supply situation to be faced in marketing the products of the year. Trends are projected as far as practical, to indicate probable market conditions beyond the next year and so aid farmers in making decisions that affect production over a longer period.

The marketing research is designed to provide basic information for increasing efficiency in processing and distribution, including transportation, so as to realize the highest net returns to the farmer from what the consumer pays for agricultural products. This involves, of course, determining what consumers want, as well as determining the costs of the services of processors, distributors, and carriers. The objective in the collection and analysis of such data has been to indicate improvements in marketing processes which will deliver the goods in best condition and at the lowest cost.

Examples of Progress and Current Programs: Some examples of the principal activities under Project 2, are shown below:

Commodity Analysis: Commodity outlook statements and analyses, including data on production, supply, demand, price, and consumption, are presented regularly in the monthly Situation Reports -- Livestock and Wool, Dairy, Poultry and Eggs, Fats and Oils, Feed, and Cotton -- in the bimonthly Wheat Situation, in the quarterly reports -- Fruit, Vegetables and Tobacco -- in the annual World Sugar Situation, and in occasional supplementary reports such as "Feed Statistics." The commodity groups are continuing to do service work on production goals and incentives, price policies, and distribution problems at the request of and in cooperation with other agencies of the Department.

Special commodity studies are being made. In the past year, a number were published in the Situation Reports, including "Note on Demand for Meat," "Subsidy Programs for Meat Animals," "Effect of Size of Family Income on Expenditures for Dairy Products," "Changes in Commercial Hatchery Production," "Outlook for World Supplies of Principal Fats," "Factors Associated with Farm Sales of Corn," "Exportable Supplies of Wheat by States," "World Citrus Production and Trade," "Relationship of Cigarette Consumption to Income," and "World Demand for Wool 1945-46." Several interbureau research

studies have been published recently in separate form, including "United States Cotton Price Support, Sales, and Export Programs," "Domestic Cotton Surplus Disposal Programs," and "Readjustments in Processing and Marketing Citrus Fruits." Other interbureau projects now underway include Adjustments in Potato Production and Distribution, and Consumer Preference in Textiles. In addition, several reports were and are being prepared in collaboration with other agencies primarily for use of the House Agricultural Subcommittee on the Postwar Cotton Program. One commodity study was published as part of the series of War Records Monographs -- "Sugar During World War II." Others in this series are in progress, including studies on citrus fruits, fats and oils, cotton, wool, tobacco, meat animals, feeds, dairy products, poultry, and food grains.

Consumption Studies: Periodic analyses of the civilian supplies of major food commodities are being made. Data on production and civilian consumption of major foods, total food supply and disappearance, and nutritional review (in cooperation with the Bureau of Human Nutrition and Home Economics) are presented each quarter in "The National Food Situation." The Bureau cooperates with other agencies in the Department and the Food and Agriculture Organization on international comparisons of food consumption levels, and provides general service to farm organizations, trade associations businessmen and the general public on matters relating to food consumption. Consumption data on 170 individual foods were furnished for the joint publication with BHNHE of "Nutritive Value of the Per Capita Food Supply, 1909-45." The first four articles in the series, "Wartime Changes in Food Consumption and their Implications for Postwar Demand for Food" have been published, as well as other studies including "Food Consumption in the United States: World Wars I and II." Figure 13 indicates the changes in per capita food production and civilian food consumption in the United States from 1925 to 1946.

The data on wartime consumption indicate that U. S. civilians have been eating more food in the past few years than ever before despite recurring shortages of some foods such as meats, butter, canned fruits, resulting from accelerated consumer demand as well as non-civilian takings. The nutritive analysis of food supplies shows the marked increases in the average supplies of most essential nutrients during the war. Important factors in the improved quality of the food supply are increases in the consumption of milk, eggs, vegetables and citrus fruit and the enrichment of white flour and bread.

A bulletin containing statistical data on the consumption of 150 to 200 food items for the years 1909-46 is being prepared in response to requests for this type of information. It will also include information on sources and methods.

"High Level Food Consumption in the United States." The object of this study was to define an attainable high level of food consumption for the United States and to estimate the quantities of additional foods required. Taking the 1941 food consumption as the base, the study showed that the most significant increases would be needed in milk and leafy green and yellow vegetables. More tomatoes and citrus fruit, meat, poultry and fish would also be needed. At 1941 prices, consumers would need to spend an additional 3.4 billion dollars to achieve the high level.



Income Analysis: Progress has been made on the development of State estimates of farm income and expenditures. Annual estimates of cash receipts by commodities in each State were extended back to 1924, and were published along with a detailed statement as to the methods used in making the estimates. Revised State estimates of gross income, production expenses, and realized net income of farm operators for the years 1929 and 1939-44 were also completed and published. These State estimates will make it possible to compare farm income with income from other occupations on a State basis, and were published as Part VI in the study, "Income Parity for Agriculture." Current annual estimates, covering the previous calendar year, were published for the first time. These estimates for 1945 are shown in Figure 14.

Much of the preliminary work necessary for the development of income size distributions for farm families was also completed during the year. Plans were also developed, in cooperation with other agencies, for utilizing the results of special income surveys conducted by the Bureau of the Census.

"Changing Composition of Family Budgets for Selected Groups of Corn Belt Farmers 1940-42:" This is a preliminary budget study of a selected group of 1,009 Corn Belt farmers from whom continuous records were obtained over the three year period 1940-42. The immediate objectives are (1) to describe the composition of farm-family budgets, classified by income and family size, (2) to measure the changes in income-outlay associated with changes in income and in the size of household, and (3) to help lay the groundwork for more comprehensive and continuous analyses of consumer expenditures and savings.

It was shown that farm families in the Corn Belt States increase their expenditures for family living as their incomes rise but at a declining rate. In other words, the percentage of income devoted to family living declines consistently as incomes rise. The situation is quite different with respect to capital expenditures. Farm families tend to spend a larger percent of their income for the purchase of capital goods as their incomes rise. Thus family expenditures may be considered the fixed component of the farm family budget and capital expenditures the flexible component.

General Price and Economic Analysis: Analyses and forecasts of trends in the general economic situation are made with respect to consumer incomes and expenditures, industrial production, employment, wages, and price level and foreign trade in relation to the effects of changes in these items on the demand for farm products. These analyses are published monthly in the Bureau's "Demand and Price Situation." Special studies on Inflationary Tendencies in early 1946 compared with the period following World War I and Recent Developments in Foreign Trade have been made. The movement of commodity prices as represented in the Index Numbers of Prices Received by Farmers and Prices Paid by Farmers are studied in relation to movements in the general price level. Figure 15 shows the relationship between prices received by farmers and prices paid by farmers, interest and taxes, from 1910 to date. A special statistical investigation is under way to determine the fundamental factors affecting the total output of agricultural products and the influence of output on agricultural prices.

Consumer Preferences for Farm Products: Field work has been completed on a consumers' preference study of the competitive position of cotton and

other fibers in the retail market. In a national sample both urban and rural women were interviewed to find out the proportion who had preferences with respect to fiber in selected articles of women's clothing and household textiles, and the proportion that did not, their views as to the advantages and disadvantages of different fibers in these products, and the features of these products which most strongly influence their choices when making purchases. Market outlets for textiles are determined to a very important degree by the actions of ultimate consumers. Information relating to consumers' preferences and the factors affecting their choices of textiles and other products should be helpful to farmers in planning their production and marketing programs and also to processors and manufacturers who supply the articles that the consumers buy. Similar studies with respect to many farm products should be useful with respect to demand analysis work. Since the demand for agricultural products will be influenced by how well they meet consumer wants and desires, the results of consumer preference studies should help farmers to secure a maximum market for their products.

Marketing Costs and Margins: Cash income received for farm products sold in the domestic civilian markets depends on 3 things: (1) the total amount of money consumers have to spend; (2) the proportion of this amount spent for food and other agricultural commodities; (3) total marketing charges deducted from consumer expenditures for farm products at retail. Farmers can only indirectly influence consumer incomes, and the percentage of that income spent for food can be increased only with great difficulty, as evidenced by the fact that the percentage has remained remarkably constant over a long period of years in which economic conditions have fluctuated greatly. This indicates the importance of the problem of making marketing more efficient and less costly.

The Bureau has completed a number of reports dealing with marketing costs and margins, which will furnish an excellent basis for pointing up research and action programs designed to overcome specific weaknesses in the marketing system.

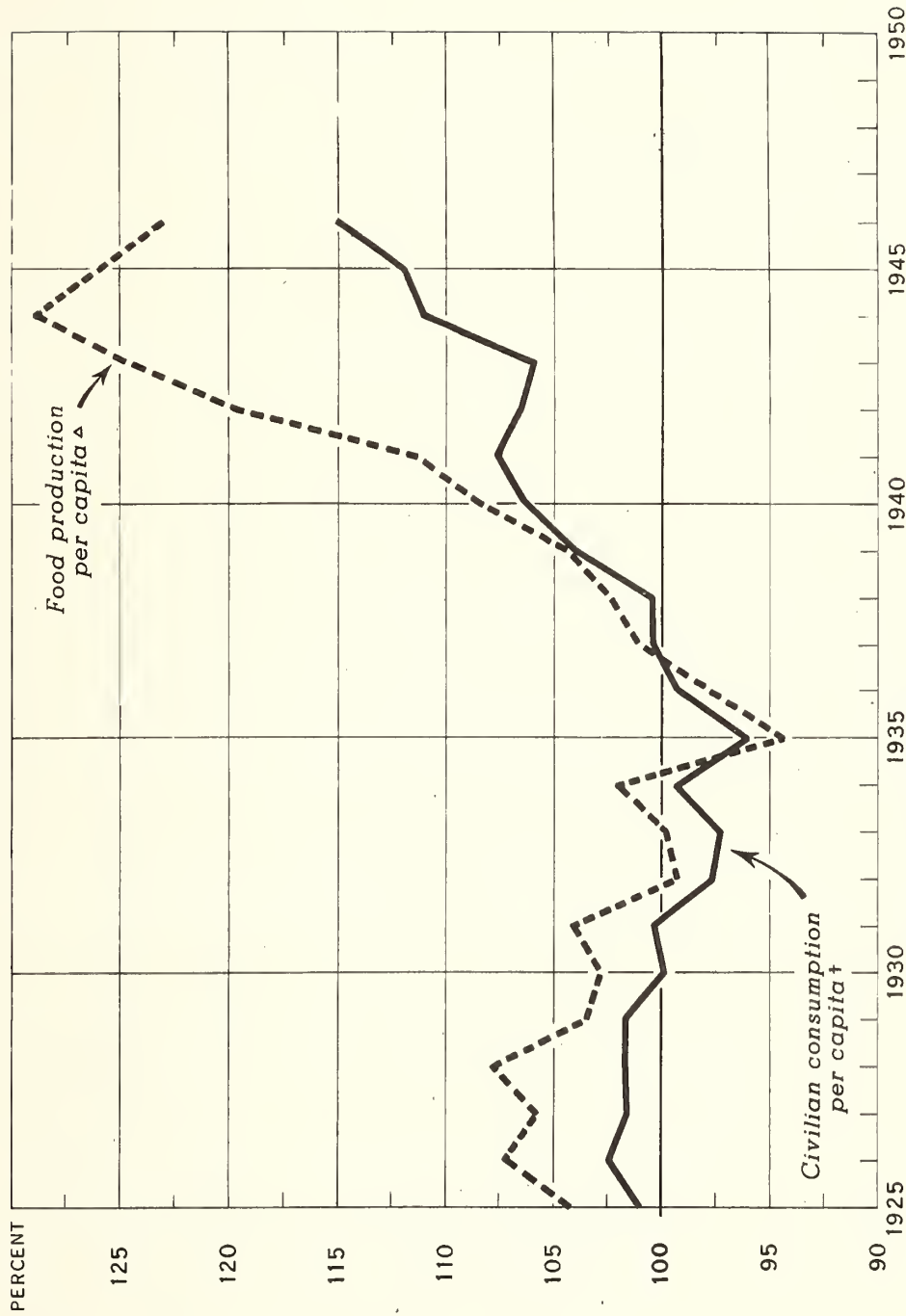
The first of these reports issued in September, 1945, deals with the over-all farm-retail margin or price spread, showing the behavior of this margin for all farm products, and for all important commodity groups and individual products, over the years since before World War I. Figure 16 shows the retail cost, the farm value and the marketing charges for a typical market basket of farm food products. The lower section of the chart indicates the division of the consumer's dollar between farmers and marketing agencies.

Other reports which have been completed deal with the detailed break-down of the over-all farm-retail margin for all important commodity groups. These show, first, the channels through which these farm products move, the quantities moving in each channel, and the relative importance of the different uses made of the raw products. The consumer's dollar paid for these commodities is broken down into the part received by the farmer and the parts going to all of the various marketing agencies, weighted according to their relative importance in the marketing channels. Marketing costs also are broken down into the amounts going for the different



# FOOD PRODUCTION AND CIVILIAN FOOD CONSUMPTION ON A PER CAPITA BASIS, 1925-46 \*

INDEX NUMBERS (1935-39=100)

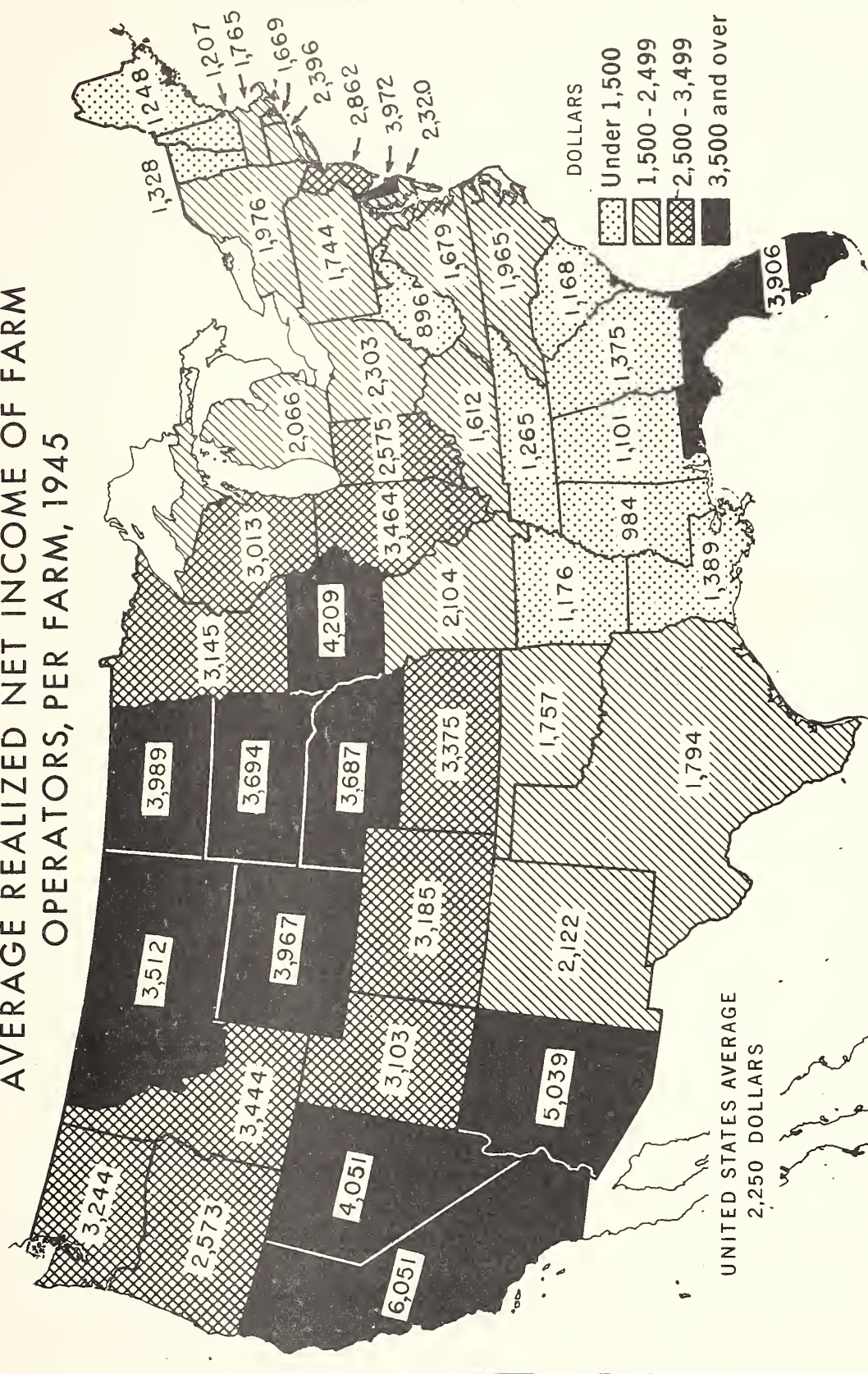


\* DATA FOR 1946 ARE PRELIMINARY  
Δ PRODUCTION OF PRINCIPAL AGRICULTURAL FOOD COMMODITIES FOR SALE AND  
FOR FARM HOME CONSUMPTION DIVIDED BY THE TOTAL POPULATION  
† AVERAGE CONSUMPTION FOR TOTAL POPULATION, 1925-40; AVERAGE  
CONSUMPTION FOR CIVILIAN POPULATION ONLY, 1941-46

FIGURE 13



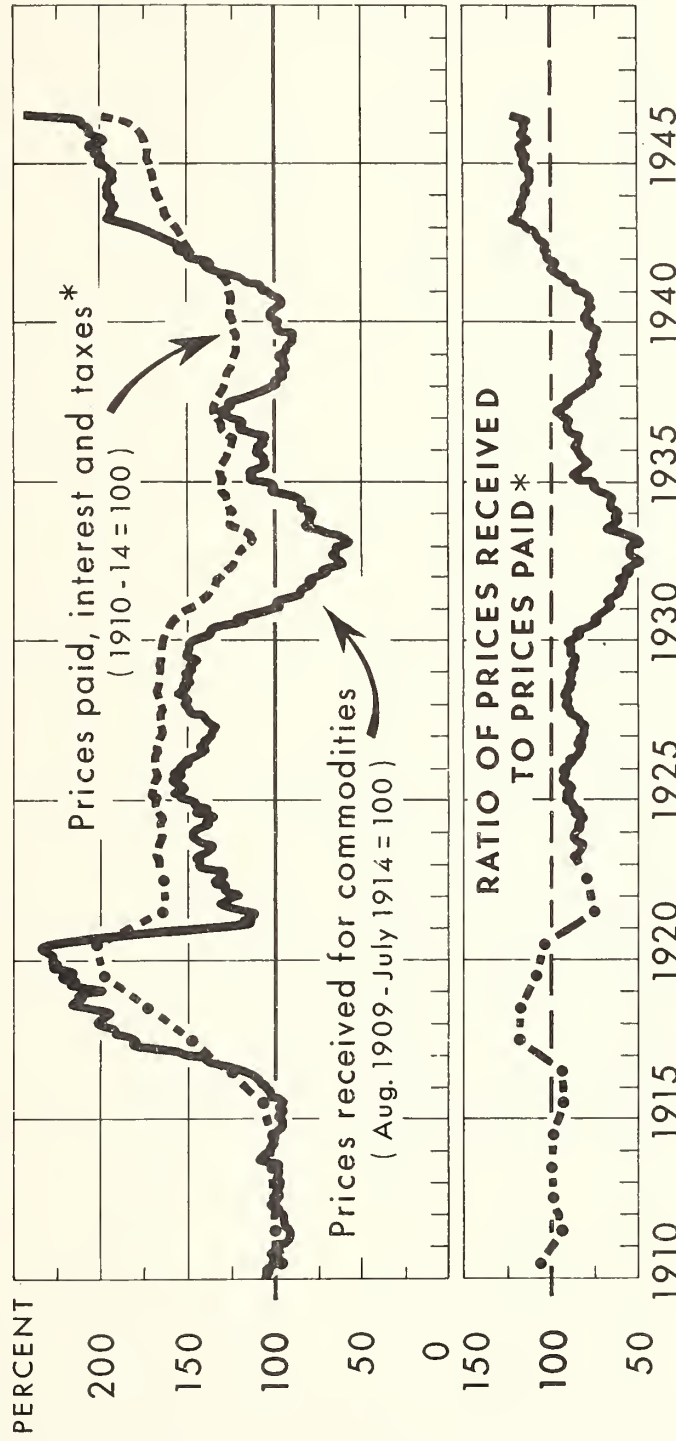
# AVERAGE REALIZED NET INCOME OF FARM OPERATORS, PER FARM, 1945







# PRICES RECEIVED AND PAID BY FARMERS, INDEX NUMBERS, UNITED STATES, BY MONTHS, 1910-46



\* PRICES PAID NOT AVAILABLE BY MONTHS, 1910-22

U. S. DEPARTMENT OF AGRICULTURE

NEG. 39935-X

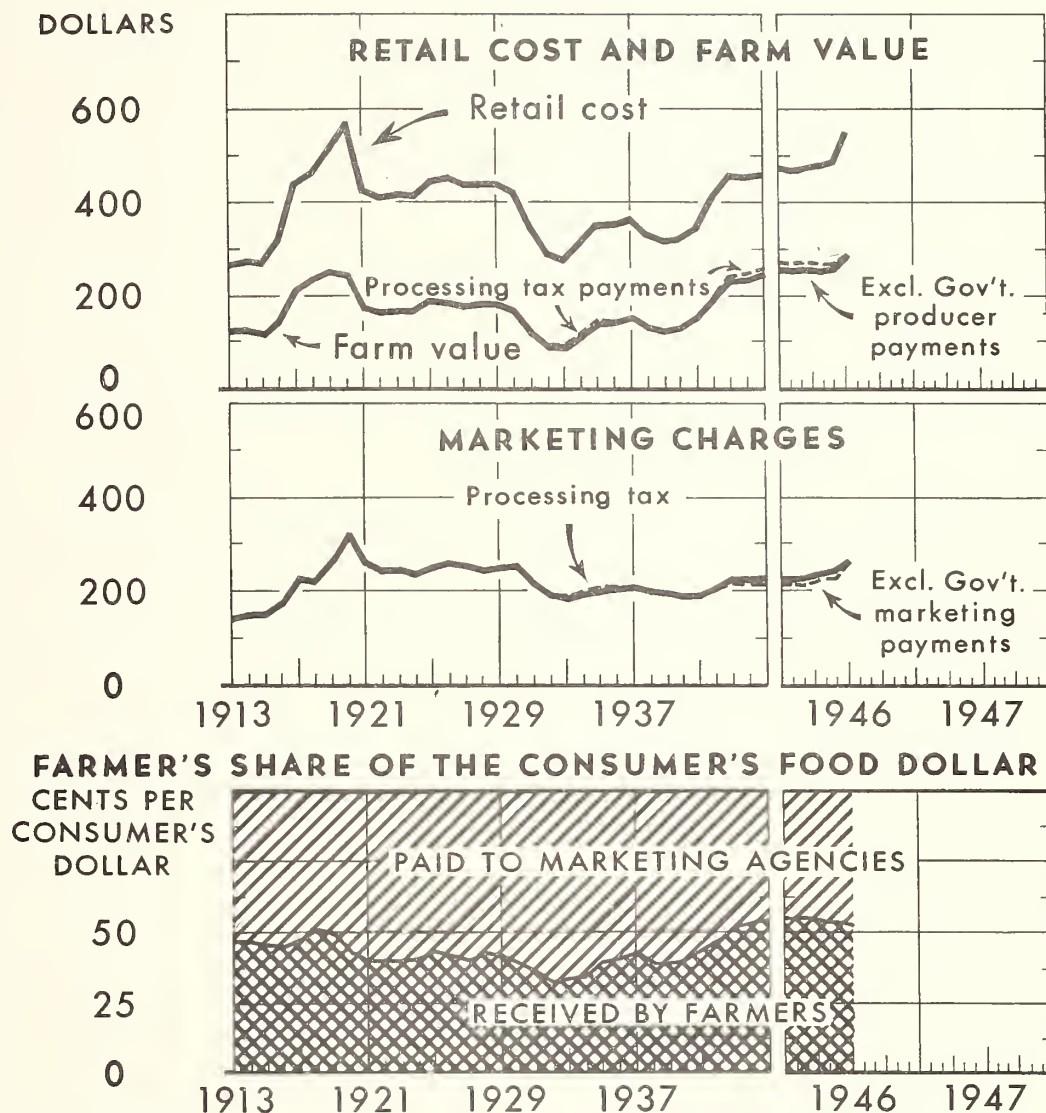
BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 15

The index of prices received by farmers increased sharply from 1940 until early in 1943. Although there was a slight upward trend during 1944 and 1945, further increases were not substantial until the first few months of 1946. By July and August the index rose to the highest level on record. The parity index (prices paid for commodities, interest and taxes) has risen continuously since 1940, and in August was also at a record high level. The ratio of prices received to prices paid, interest and taxes, has been above 100 since 1943. The wartime peak of 123 was established in April 1943 and July 1946. This ratio will be lower in 1947 but may still be above 100.



# FARM FOOD PRODUCTS: PRICES, MARKETING CHARGES, AND FARMER'S SHARE OF CONSUMER'S DOLLAR, 1913-46 \*



\*AV. ANNUAL PURCHASES PER FAMILY OF THREE AV. CONSUMERS, 1935-39

Lapse of price controls and subsidies resulted in record price increases from June to July 1946. Prices received by farmers for food products reached a new high. The farmer's share of the consumer's dollar spent for farm food products declined from a record level of 55 cents during the first 3 months of 1946 to 52 cents in July. Retail prices of these foods have not yet matched the levels reached in 1920.





marketing services such as farm assembly, transportation, processing, wholesaling, retailing and the like, and into the different items of marketing costs such as labor, advertising and profits.

These data furnish an excellent beginning for pointing to the various parts of the marketing system where possible economies might be effected. For example, they show that the farm end of the marketing system, such as the merchandising of raw cotton from grower to cotton mill, absorbs generally a very small part of total marketing charges or costs. Figure 17 shows the approximate distribution of the consumer's dollar paid for apparel and household goods made of cotton in 1939. It is shown that retailing, to which relatively little attention has been given in research and action programs designed to reduce marketing costs, absorbs by far the largest single share of the marketing costs. The report indicates that the "high cost of marketing" results from high costs rather than large profits per dollar of sales made by middlemen, and points to certain of these costs as being particularly vulnerable.

Although these studies represent only a beginning in this most important field of marketing research, they do show some of the possibilities of improving marketing efficiency and reducing the costs of rendering marketing services.

Research on Terminal Market Reorganization: During the past year studies were completed for the San Antonio and Cincinnati markets. In both of these cities city officials, the Chamber of Commerce and market interests have been working in cooperation with the Bureau to implement the recommendations resulting from these studies. The report for the San Antonio market was published by the Planning Board of that city, and already a consulting engineer has been employed to prepare detailed plans, specifications and cost estimates for a complete new market. This will be a combination of a concentration market for distribution of the fruits and vegetables of South Texas, and a wholesale market to supply San Antonio and its trade area.

The Bureau report on the reorganization needs of the Cincinnati market was published by the Planning Commission of Cincinnati as one of a series of technical reports for the Metropolitan Master Plan for Cincinnati. Final decision on the market reorganization will have to be integrated with decisions on flood control and other projects.

The City of Dallas recently opened bids for the construction in line with this Bureau's recommendations of the first group of stores for wholesale dealers in the new market contemplated for that city. Changes in new highway routings in St. Louis have precipitated action with respect to a new market for that city, a study of which was made by this Bureau in 1940. Representatives of the wholesale dealers of San Francisco have met with the Bureau representatives to study the location, layout and operations of the market which apparently will be built eventually in the Coast city to replace the very inadequate facilities now being used there.

A study of Southern concentration markets for fruits and vegetables, made in cooperation with the agricultural experiment stations of several Southern

States, also was completed during the past fiscal year, and will be published as research bulletins of the several stations. This study analyzes the types of concentration markets which have been tried out in various parts of the South, and makes suggestions looking toward more effective facilities and operating methods, based on the experiences of the different kinds of markets now in operation.

Pre-packaging fresh fruits and vegetables: There has been a surge of interest on the part of producers, shippers, wholesalers and retailers of fresh fruits and vegetables in the new method of merchandising produce in consumer-size packages, commonly referred to as "pre-packaging". The demand for information on this subject has been most pressing. Fortunately, as a part of its work on postwar technological changes in marketing the Bureau has had underway during the past year a research project dealing with this new marketing development. Although the work will not be completed until sometime in fiscal 1947, sufficient information has been adduced to furnish valuable guides to groups which have contemplated installing facilities and beginning operations.

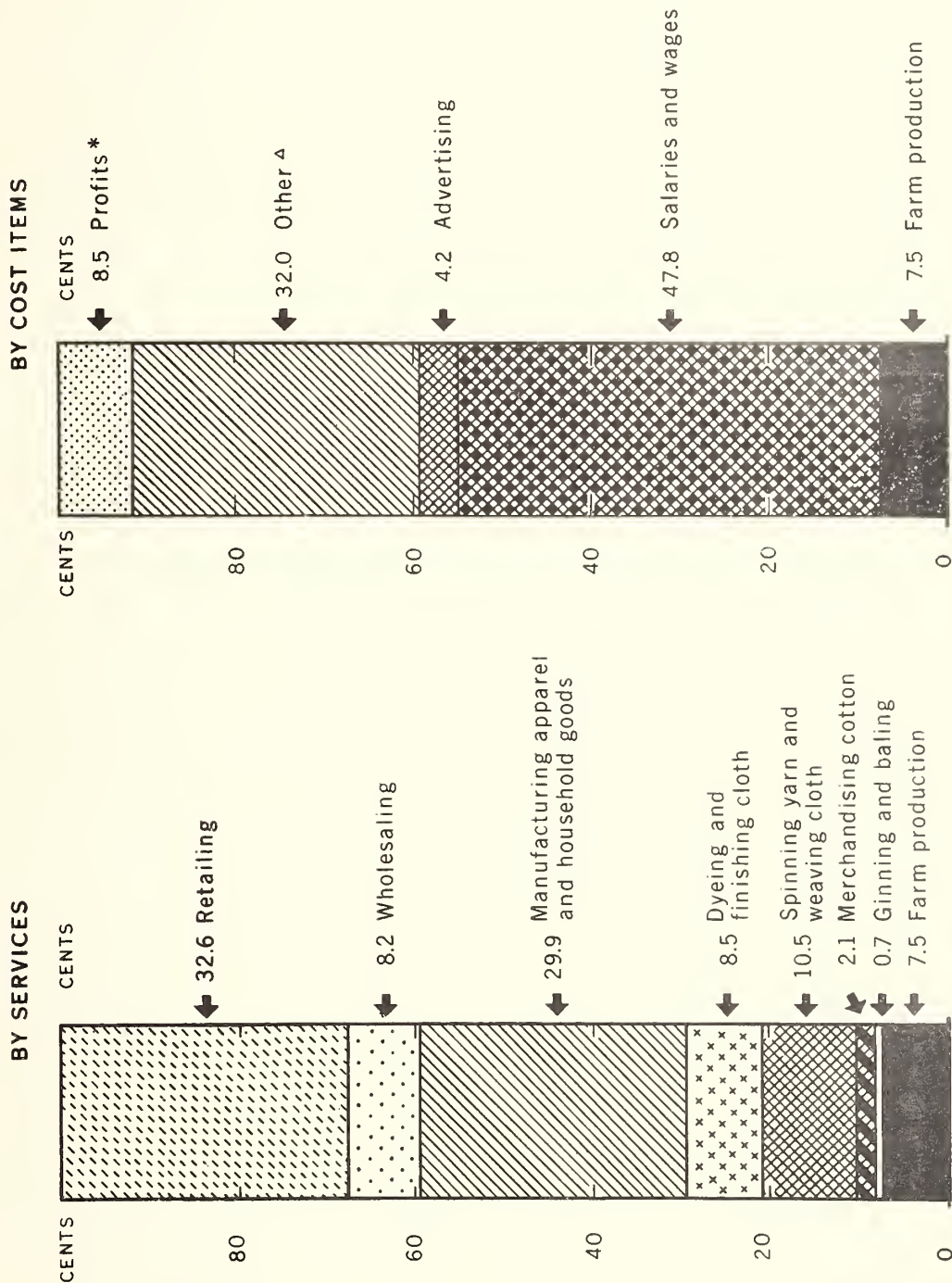
Similarly, although the research on frozen foods is just getting underway, enough information has been assembled to be of considerable help to veterans and others contemplating entering this new business. Likewise, the research on air transport of agricultural perishables, culminating in a series of reports which became available during the past year, already has been used to a large extent by airlines and others getting into this business, which is full of hazards and presents many uncharted courses for which the Bureau's research has furnished helpful markers, both to existing and potential operators and to producing and shipping groups which are interested in making use of this new form of transportation. Other research projects on the economies of the technological phases of marketing, such as improvement in the uses of refrigerator cars, also have yielded partial results before completion, for the use of the many producing and marketing groups interested in these new marketing methods.

Citrus fruits: During the war greatly expanded needs for citrus fruit and its products to meet the requirements of the armed forces, foreign relief and an expanded demand, have resulted in a prosperous market for these commodities. But producers and marketing organizations saw storm clouds ahead, and the Bureau was requested to make a study of the postwar market situation for citrus fruits and possible methods of dealing with the problems which are likely to arise. This work resulted in a report embodying much detailed information about new processing methods and other factors bearing on the ability of citrus producers to meet the less favorable conditions which may lie ahead. The report includes an analysis of the prospects for future production, export outlets, byproducts, processed products and other subjects.

Livestock marketing: In cooperation with the experiment stations of 12 Corn Belt States, a study was made of price differentials for hogs in the livestock markets and price differentials among hogs in the different grade and weight divisions. This information has been much needed in the past, and will be needed in the future, in connection with price support and control programs, and as a basis for better selection of markets by

# APPROXIMATE DISTRIBUTION OF THE CONSUMER'S DOLLAR PAID FOR APPAREL AND HOUSEHOLD GOODS MADE OF COTTON, UNITED STATES, 1939

(BASED ON OFFICIAL AND OTHER DATA AND PARTLY ESTIMATED)



\* PROFITS TO FARM PRODUCERS NOT INCLUDED

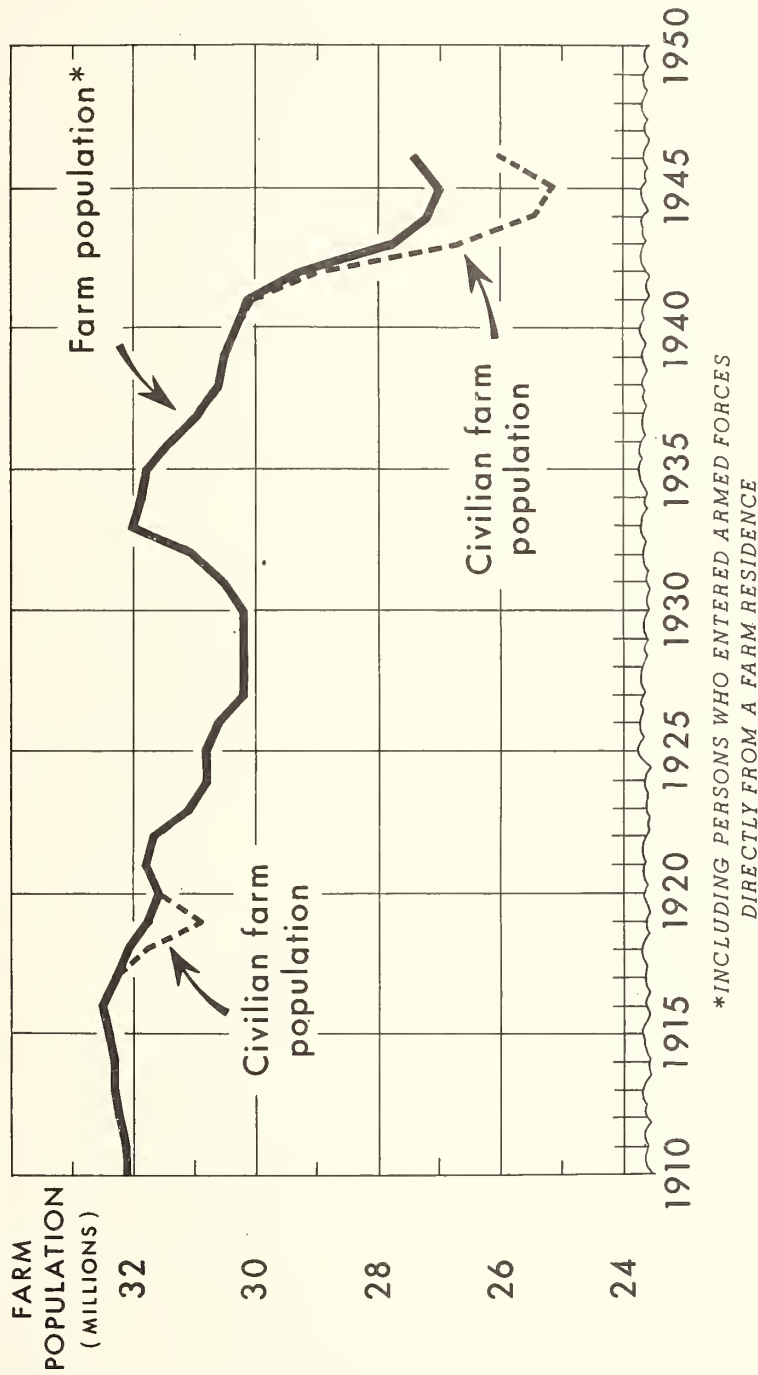
^ TRANSPORTATION, STORAGE, INSURANCE, SELLING EXPENSES, DEPRECIATION, TAXES, ETC.

FIGURE 17





# FARM POPULATION, UNITED STATES, 1910-46



U. S. DEPARTMENT OF AGRICULTURE

NEG. 43457-X

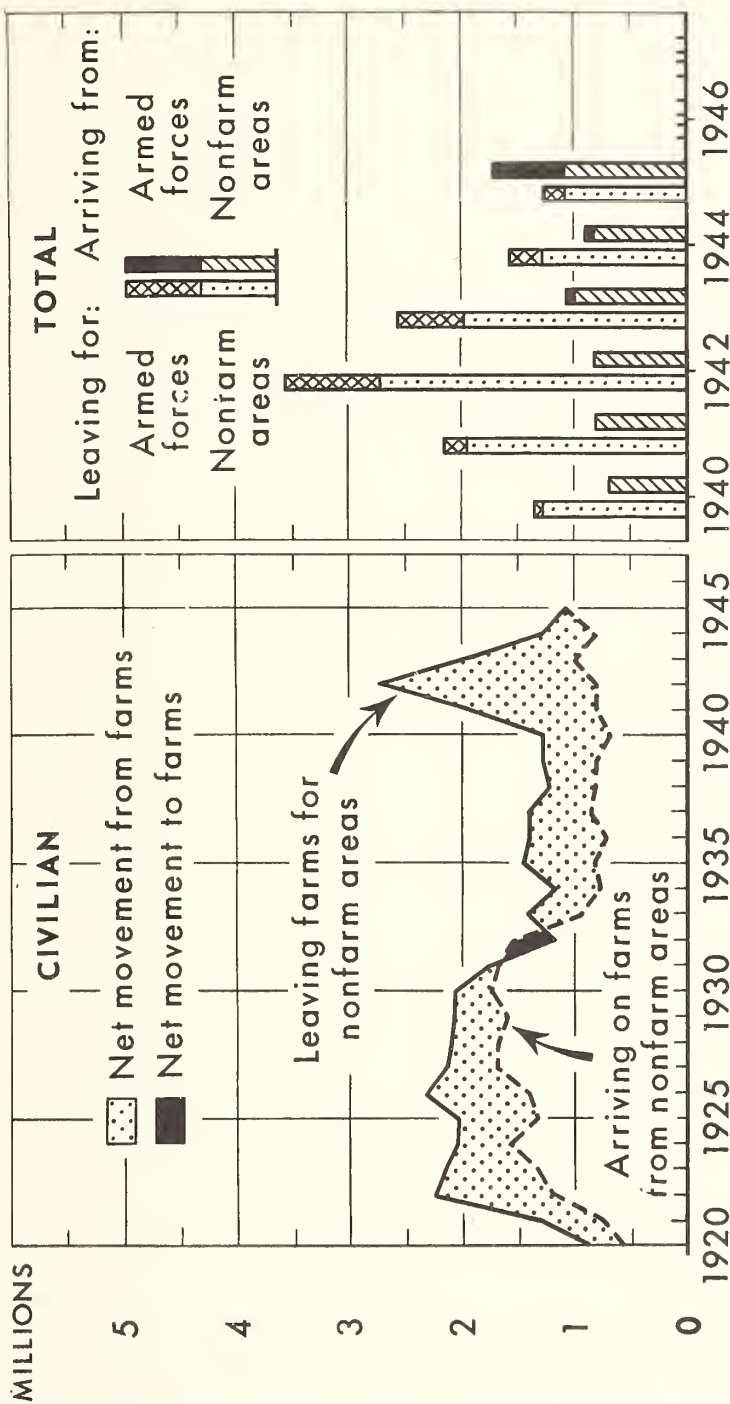
BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 18

Between 1910 and 1916, the farm population was still growing and reached its highest level of 32.5 million in 1916. During World War I and the decade which followed, nonfarm employment opportunities were good and stimulated high rates of migration from farms to cities. By 1930, farm population was down to 30.2 million. The great depression of the early 1930's was quickly reflected in a large increase in the farm population, mostly because hundreds of thousands of young people remained on farms who would have migrated to cities if there had been jobs available. With some economic recovery, migration from farms picked up and by 1940, the farm population was at about the same level as in 1930. During the war years, very high rates of migration from farms to cities and the entrance of farm men into the armed forces brought the civilian farm population to the low level of 25.2 million in January 1945. Since the end of the war, the number of people living on farms has been increasing.



# MOVEMENT TO AND FROM FARMS, UNITED STATES, 1920-45\*



\*BIRTHS AND DEATHS NOT TAKEN INTO ACCOUNT

U. S. DEPARTMENT OF AGRICULTURE

NEG. 27495-X

BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 19

Every year a great many people move away from farms to cities, towns and villages, and a somewhat smaller number usually move to farms. Those moving in both directions include families and single individuals, but there are many more young people in the migration from farms. As a result of long-continued high birth rates on farms, young people reaching working age each year are more numerous than are the job opportunities becoming available through death or retirement of older farm men. This is the main reason for net migration from farms. During World War II, the demand for manpower in industry and the expansion of the armed forces led to heavy movement from farms. Since the end of the war, World War II veterans and others who left the farms during the wartime have been returning.





livestock producers. Proper use of the information developed in this study also will aid farmers in planning their production programs so as to make most effective use of market potentials and production facilities.

Textile manufacturing and distribution: The analysis of marketing and manufacturing margins for textiles has been expanded during the past year in connection with the research program on the postwar agricultural and economic problems of the Cotton Belt, and detailed analyses have been made to show the techniques, costs and margins in the manufacture and distribution of cotton products as a basis for indicating the means by which the improvements and efficiencies might be made and outlets for cotton goods expanded. The section "Techniques, Costs and Margins in Distributing Cotton Products", representing one segment of Project III of the research program under the direction of Honorable Stephen Pace, has been completed and published as a preliminary report.

Agricultural-industrial activities: For several years a representative of this Bureau has served as chairman of an Inter-Bureau working group dealing with agricultural-industrial activities.

During the fiscal year 1946 the major accomplishments of this work were two bulletins prepared in cooperation with the Department of Commerce and published by them as follows: "Will Making Concrete Block Pay in Your Community?" and "Manufacturing Brick and Tile to Serve Your Community." The bulletin on concrete blocks was published in November 1945; and one on brick and tile is at the printing office and will be released soon.

These bulletins were designed to assist business and community groups in small, rural communities who wish to set up a concrete block or a brick and tile plant as a means of providing needed products and offering new opportunities for employment. The bulletins include technical data on the manufacturing processes, economic analyses of prospects in the industry, and estimates of costs of establishing and operating a plant of given size.

### 3. Farm Population and Rural Welfare:

The work under this project is concerned primarily with farm people--how many there are, where they live, how many are in the farm work force, how many are hired and how many family workers, what their levels and standards of living are, what rural organizations and community relationships they develop, what their preferences are for goods and services, and the effectiveness with which agricultural activities designed to serve them are meeting their needs and receiving their cooperation. The work provides a basis for considering the welfare of farm people generally as compared to that of non-farm people. Many of the studies in this field are fundamental to other research and estimating work of the bureau.

Examples of Progress and Current Programs: Some examples of the principal activities under Project 3, "Farm Population and Rural Welfare" are shown below:

Farm Population Estimates: The work on farm population includes collection of data on the numbers of persons moving to and from farms each year and

the making of cooperative current estimates of the number of persons and families living on farms, with information on age, sex, and veteran's status of farm residents. During the war and in the period since the war ended, there has been very heavy migration to and from farms, which affects both the farm labor supply and the total number of people who earn their living from agriculture. The work on farm population provides for a continuous record of the changes taking place and includes studies of related factors which produce changes in the number of people living on farms. In addition, continuous cooperative work is carried on with the Bureau of the Census in improving the farm population information gathered and in developing fuller information on farm people according to the size and types of farms on which they live.

Results of this work showed that in the 5 years from January 1, 1940 to January 1, 1945 farm population decreased from a level of approximately 30 million to 25 million, a net decrease of 16.8 percent. This net loss of about 5 million in farm population was the result of (1) 5,136,000 civilians of all ages who either moved away from farms to cities, towns, or villages, or who were living on places which no longer classified as farms because farm operations had ceased, (2) 1,850,000 persons who were living on farms at the time they entered the armed forces, including about 1,300,000 in the farm work force, and (3) a net addition of 1,907,000 persons through the excess of births over deaths in the farm population.

By January 1946 this long time trend had been reversed, probably temporarily. During 1945 the farm population showed a net increase for the first year since 1932. This net increase amounted to almost one million persons, about half of the net increase being due to veterans returning to farms. (See Figures 18 and 19.)

Levels of Living: Work on levels of living has been primarily an attempt to determine to what extent and in what ways farmers' levels of living compare favorably or unfavorably with those of non-farm families, and in what ways and how farmers are making progress in improving their levels of living. Attention has been given to gathering, through field surveys, data to supplement those now available in census reports. Special attention has been given to housing conditions, availability and use of electricity and electrical equipment, medical and health needs and services, and availability of community facilities and organizations and farm family participation in them. Data available on these and other items have been summarized for publication in a manuscript entitled "Trends in Farm Family Levels and Standards of Living." Level of living indexes for counties have been developed which show variations in levels of living between different sections of the country and between areas within States. (See Figure 20.)

Data now available in this field, while valuable in themselves, constitute a bench mark for future systematic study and reporting on rural welfare as measured by the levels of living of farm people. It is planned to devote more attention to this work because it is believed that the levels of living of farm families in the long run is the best, if not the only, sure measurement of what farm people themselves receive from their contribution to the total economy of the nation. It is expected that



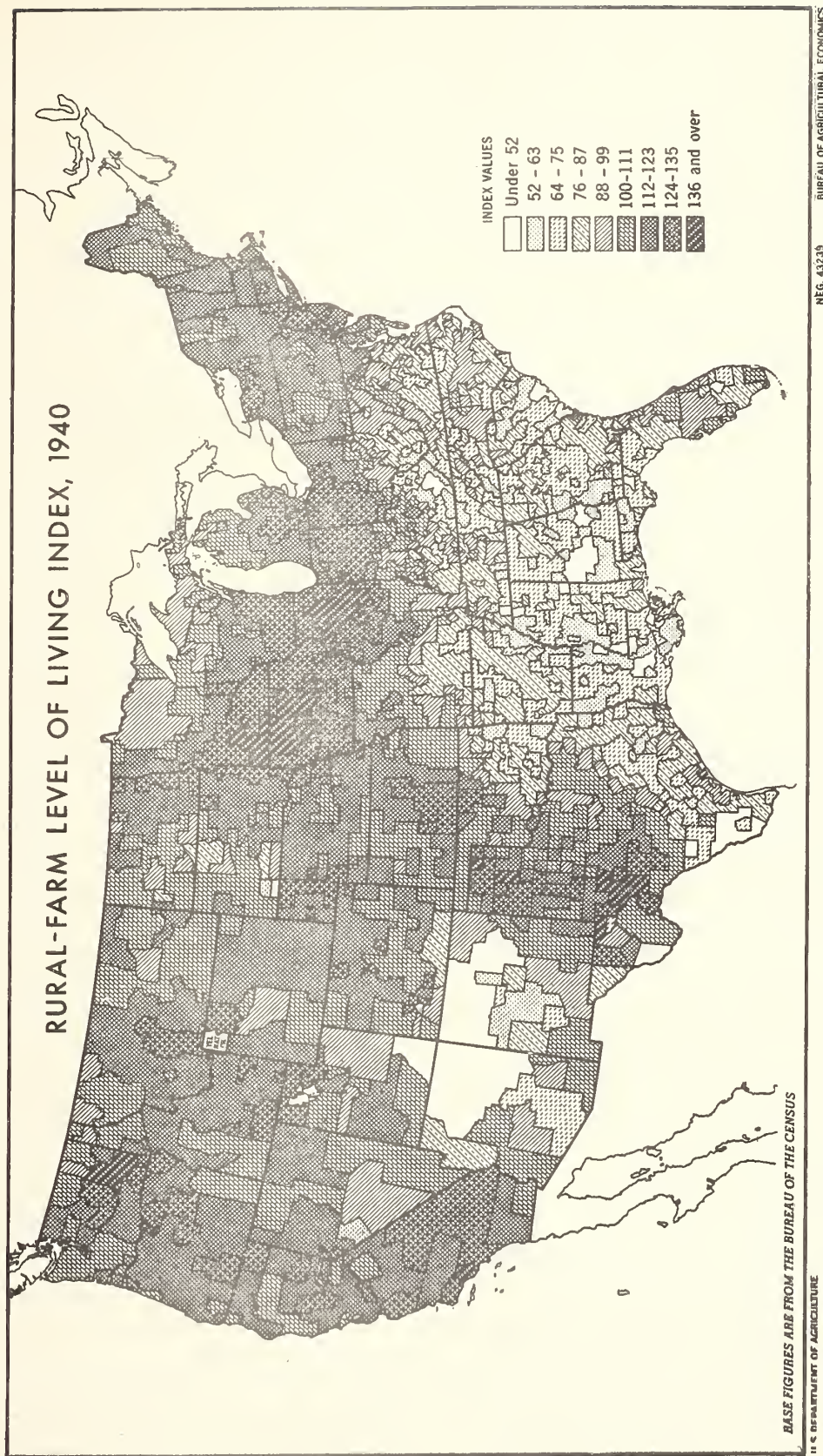


FIGURE 20





work accomplished and reported on farmers' levels of living will eventually be comparable with the series on farm prices, acres planted, and prices paid by farmers.

Since the security-insecurity problems of farm people affect their levels of living the bureau has made a special analysis of problems and issues which might arise if the proposed extension of social security coverage to farmers and farm laborers were enacted into law. In cooperation with the Social Security Board the bureau has given attention to a study of possible benefits to be derived by farm people, contributions to be made by farmers and farm laborers, and administrative and reporting techniques which would be likely to be most workable and acceptable to farmers. Conferences have been held with farm organization leaders and at their request a question and answer leaflet was published, in cooperation with the Social Security Board, on "Social Security for Farm People."

Rural Organization: The work on rural organization includes systematic analysis of types of rural organization, rural patterns of association, leadership, change, and the processes through which rural people participate in local activities, programs and services. This work is being carried on, largely in cooperation with Land Grant Colleges, in selected counties representative of all the major types of farming regions of the country. It is developed in such a way as to be of value not only to rural people themselves in connection with their activities in improving rural conditions but also to agencies and groups who serve them. It will give agencies such as extension, soil conservation and public health information of value in organizing and carrying on their programs. The analysis and summary of experimental health programs which were set up by the Department's Interbureau Committee on Post War Programs has been completed and published by the Sub-Committee on Wartime Health and Education of the Committee on Education and Labor, United States Senate. The research work in rural health as related to rural organization includes studies to assist local people and agencies in appraising needs and determining the appropriate location for health facilities and personnel.

Farm Labor: Work in farm labor has been of special importance due to the fact that farmers have had great difficulty in securing labor in recent years. The work has included development of information and the making of studies on the farm labor supply, the size and make-up of the farm working force, wages and perquisites of hired farm workers, including migratory workers, and on income and levels of living of hired farm workers. This work includes: (1) Study of the supply and composition of the farm work force in the major areas of the country; (2) study of wage rates paid in different areas, on different types of farms, for different types of workers, and for different types of jobs, such as dairy work, range work, harvesting of fruits and vegetables, general farm work, etc., and of earnings and duration of employment of regular and seasonal workers; (3) study of the frequency with which housing, lodging, farm products, board and other perquisites are furnished to farm laborers, and of the cost of such items to farm operators; (4) study of the supply and employment conditions of migratory farm workers; (5) studies of the operation of farm wage ceilings in special crop areas; and (6) study of the

absorption of veterans of World War II into the farm labor force including analysis of the wages and employment conditions of those veterans who are hired farm workers. Continuous work is carried on in improving basic statistics developed by the Bureau or by other government agencies on the number of persons working on farms, on farm wage costs, and on farm wage rates and indexes.

More than a dozen reports were published during the past year which show the results of this work. They cover such matters as national and regional estimates of number and types of hired farm workers, wages and wage rates, veterans working on farms, differentials in farm labor costs by type and size of farm within different areas, and studies of harvest labor employed in local areas of intensive production of special crops such as fruits, vegetables, sugar beets, sugar cane, cotton, and hops.

It was possible during the past year to determine for the first time the number of different persons who worked on farms for wages sometime during the course of the year. In 1945 there were 4.2 million such persons. While 70 percent of them lived on farms, 20 percent lived in rural areas but not on farms, and 10 percent were urban residents. About 600,000 of the 4.2 million were farm operators who worked as hired men for other farmers a part of the year.

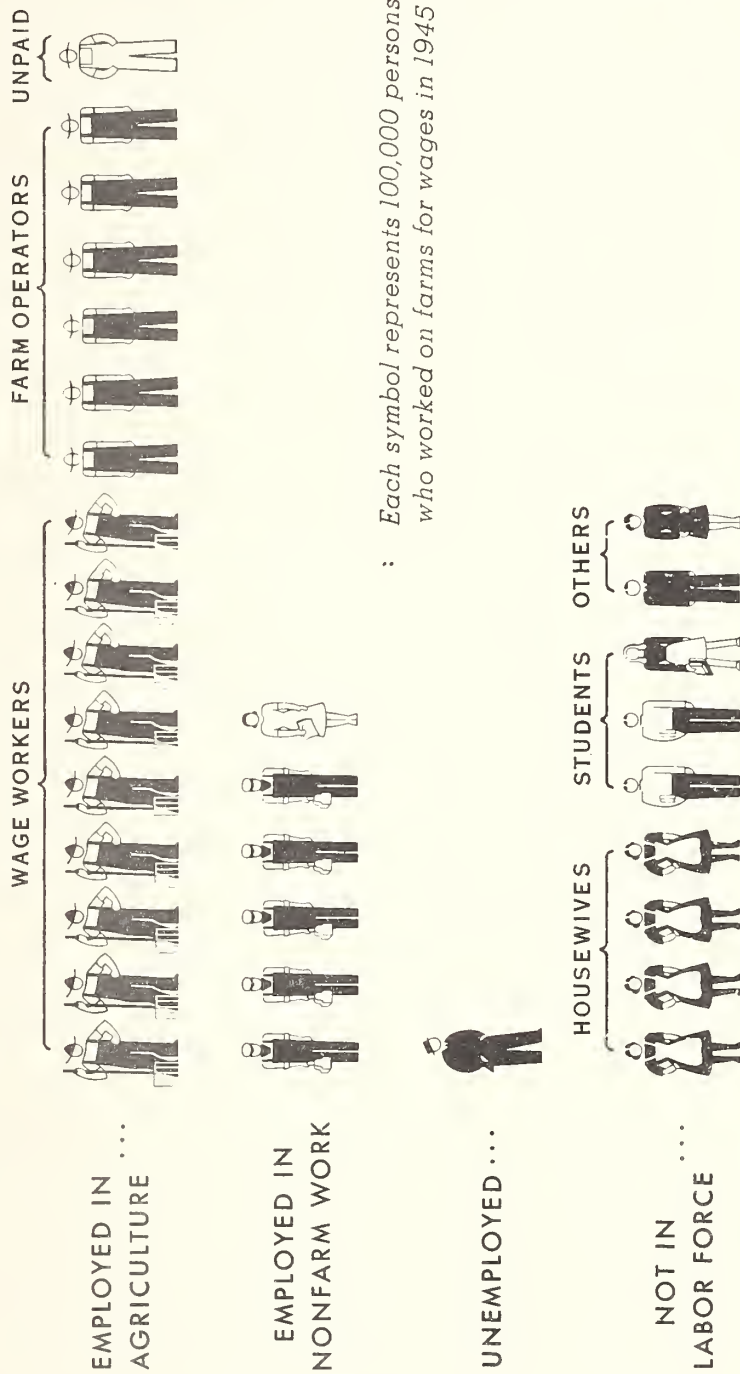
Wide variations were found in farm wage rates from one area to another, from season to season, and among different types of workers. In July 1946, for example, hired farm workers averaged 46 cents per hour for the country as a whole, but hourly cash wages varied from 36 cents in the south to 66 cents in the west. Seasonal workers in some special crops had considerably higher earnings than these averages.

By July 1, 1946 more than one million veterans of World War II had returned to farm work, about 700,000 as farm operators and members of farm operators' families, working without pay, and a little over 300,000 as hired workers. By this date veterans made up 9 percent of the total number of persons working on farms. (See Figure 21.)

Special Surveys, Including Service Surveys for Other Agencies: At the request of other agencies, and with the approval of the Secretary, special studies are undertaken from time to time as a special service to other agencies. These special surveys include the gathering of data that will help increase the effectiveness of agricultural activities or improve service to farmers. During the past year a study was undertaken, at the request of the Director of Extension of the USDA and of the Director of Extension for the State of Vermont, which was designed to obtain data helpful to the State Extension Service in improving its educational activities among farm people of the State.

The same unit is available for working in cooperation with others in the Bureau on surveys which require the skills and knowledge possessed by the workers in this unit. During the past year, two such special surveys were undertaken, one a consumer preference study on the competitive position of cotton and other fibers in the retail market, and another on farmers' views with respect to factors affecting production shifts on different

# WHAT 3,200,000 PERSONS WHO WORKED ON FARMS FOR WAGES IN 1945 WERE DOING IN JANUARY, 1946



J. S. DEPARTMENT OF AGRICULTURE

NEG. 46035-X BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 21

The hired farm working force of the summer and fall months is greatly reduced by midwinter. The 3.2 million persons 14 years of age and older in the 1945 hired working force fell by midwinter 1945-46 to a low of about 1 million hired workers; some 700,000 farm operators and members of their families who worked for wages on other farms in 1945 were back working on their own farms. About 700,000 were again housewives or students. Nearly 700,000 had returned to their nonagricultural work after a period of hired farm work during the year. About 200,000 were elderly persons and others who do not seek work in midwinter. There were other groups who did hired farm work in 1945, including children under 14, prisoners of war and imported foreign workers. These brought the total number of different persons who worked on farms for wages in 1945 to about 4.2 million.





types and sizes of hog farms. These are reported elsewhere in this statement under the appropriate headings, the consumer preference survey under "Prices, Income, and Marketing," and the one on production response under "Economics of Production."

Sources of Information, and Use of Bureau's Economic and Statistical Reports: The following chart (Figure 22) illustrates the many sources from which the Bureau obtains information and some of the groups who use the Bureau's economic and statistical reports.

(b) Crop and Livestock Estimates

In 1862 when the Department of Agriculture was created, one of its first tasks was to organize the agricultural statistics service. This service has been continued and expanded, as provided for by Congress, to meet the increased needs of the public for adequate agricultural information. At the present time, it gathers the basic data and makes the official estimates and reports on the Nation's agricultural output, covering a wide range of subjects. These include present and prospective production of all of the principal crops and classes of livestock, livestock products, dairy and poultry products, farm and non-farm stocks, utilization, prices received and prices paid by farmers, farm employment and wages, and many other types of information.

There is a continuing demand for current statistics on agricultural production and related subjects as a basis for government action on agricultural problems in the postwar period. Among the fields for which basic estimates and data are most urgently needed are in connection with administrative analyses of individual farm operations under the programs for determining maximum needs of foods and staples; providing for the transportation and storage of grain crops and the handling of expanded marketings of other farm commodities; appraisal and loan operations; and price support measures.

The following table shows for the United States, total acreage for 52 crops, and the production of specified crops, as well as livestock on farms and production of eggs and milk from 1909 to 1946. This illustrates the type of information which is kept current, and released in the hundreds of regular and special reports covering agricultural production and related subjects.

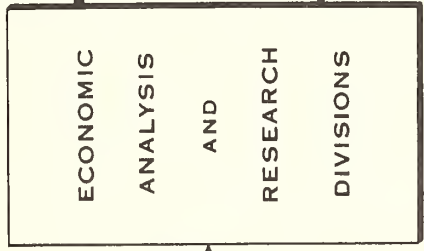
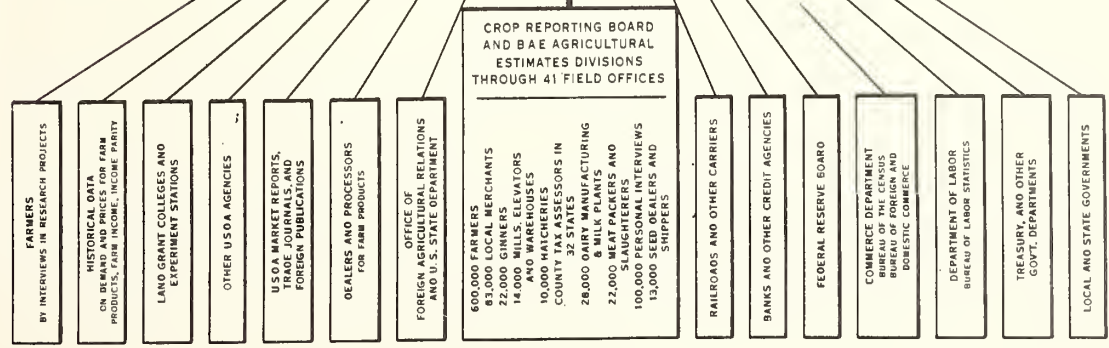
Examples of Progress and Current Programs: Out of the extensive series of established reports and services regularly scheduled throughout each year, some of the special and more important aspects of current programs under each division are shown below.

(1) Field Crops

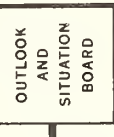
Grain, Hay and Forage Statistics: The program of quarterly stocks of grains in all positions, which has become popular since its inception in 1943 has been further expanded. State data were published for wheat, not only in the interior mill and elevator segment, but also in merchant mills, in all off-farm positions and in all positions. For corn, oats, barley and rye, not only were data published for stocks in all positions, but data by States were published in all off-farm positions. For barley and rye, farm stocks on January 1 were interpolated from December 1 survey data, and on July 1 from June 1 survey data, for a series of years from 1934 to date. Also survey data for April and October 1 were stabilized and published as additions to the regular stocks program. Thus it was possible to publish studies in all positions for these grains on the quarterly dates. The series for food and feed grains, soybeans and rice stocks, dry beans, etc., were continued.

# ECONOMIC ANALYSIS AND RESEARCH OF THE BUREAU OF AGRICULTURAL ECONOMICS

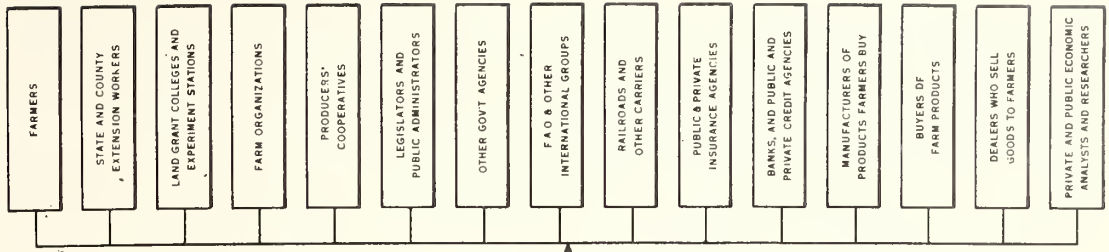
## SOURCES



RESEARCH PROJECT REPORTS



CURRENT ECONOMIC FORECASTS AND SITUATION ANALYSES



This chart shows the flow of information through the Bureau's economic analysis and research organization. Coming from a wide variety of sources and embracing a wide range of subject matter, the incoming data are the raw material used in research and analysis. When analyzed by research workers and fitted together to yield answers to practical problems, the resulting information makes up the Bureau's reports to the public on research projects and outlook and situation analyses. These reports include analyses and forecasts on demand and prices for farm products, parity price factors, farm income and income parity, reports on farm management including determinations of costs and returns on different types and sizes of farms and economic impacts of technology, farm population trends, composition of farm work force and wage rates of hired workers, and conditions of rural life, including levels of farm family living and community development and family participation, home ownership and tenure status, taxation, insurance and farm real estate values. Much research work is done in cooperation with the Land Grant Colleges.

FIGURE 22





The rice stocks program was expanded to include enumeration of mill and warehouse stocks and estimates of farm stocks as of January 1 and April 1. Special estimates of corn for grain as of October 1 and November 1 were prepared, in addition to estimates of all corn, as an aid to governmental, public and private agencies dealing with seed supplies and distribution. "Soft corn," a particularly troublesome problem in the 1945-46 season, necessitated a number of special reports to provide estimates of quantities and areas affected, as a basis of prompt action in effecting maximum utilization of the crop for feeding purposes.

Soil moisture tests in Kansas and Nebraska, together with crop frontage metering in certain western States were continued to obtain special data for use as important supplemental indications of wheat acreage and production prospects. A mid-June report of 1946 production of wheat was prepared for use in relation to storage and transportation facilities available for handling the record 1946 wheat crop. Special reports of stocks of wheat on farms May 1 and May 15 were prepared in connection with the Government emergency program to purchase wheat for export to famine areas.

Special estimates on proportions of the total acreage planted to the new disease-resistant and high-producing oats were made in a number of the North Central States. A survey of barley varieties in Wisconsin, North Dakota and South Dakota was made in response to requests for such information by those interested in barley use and disposition. Estimates of sorghum were changed over to the "all sorghum" basis for estimating acreage and utilization. Improved procedures were put into effect for forecasting on August 1, the acreage of sorghum for grain. A comprehensive report on "Harvesting the Hay Crop" showing harvesting practices used in the several States was prepared from more than 20,000 responses by crop correspondents and was published by the Bureau.

The county estimates program for corn, wheat, flaxseed, rice and soybeans begun a few years ago, was continued and has earned much favorable comment. County estimates for all major commodities are requested more and more as a part of the regular program of the Bureau, as the expanding use of current reports and statistics stresses the need of data for areas smaller than a State.

Acreage and yield estimates by special cropping practices were initiated for specified counties in about 17 western States for use by the Federal Crop Insurance Corporation in establishing differentials in rates on insurance for wheat and cotton. Estimates of inventory stocks and inventory value of products on farms January 1, for commodities not covered in regular stocks reports, such as corn and sorghum silage and forage, flaxseed, sorghum grain, buckwheat, etc., were prepared.

Cotton Statistics: The regular estimates of acreage in cultivation on July 1, condition and forecasts of production and yield each month from August to December and final revisions in April were made as well as a very large number of special reports on losses from various causes, cost of fertilizer used, monthly marketings, values of cotton and cotton seed and other data. Much historical material, summaries and

computations were prepared for the Production Goals Committee, for committees of Congress, and other agencies.

Farm production, farm disposition, and value of cotton and cotton seed and related data for years 1928 through 1944 by States were brought together in one publication and released for general use. This publication filled a vital need and is very much in demand.

County estimates of cotton acreage, yield and production in 1945 have been prepared and published for all cotton-producing counties in the United States. These county estimates are used by the Federal Crop Insurance Corporation as basic information in setting the general level of cotton insurance rates and by other Federal and State agencies in administering cotton programs, and by many other governmental and private agencies.

The high standard of accuracy maintained for cotton acreage and production estimates is made possible by continually working toward improvements in estimating technique. Research is an integral part of the program for estimating cotton, as in the case of other crops and commodities. When a new technique is developed, it is thoroughly tested before put into general use. The re-designing of schedules and methods of estimating has resulted in a substantial saving in the time required to prepare a release. At the same time the accuracy of estimates has been maintained if not increased.

Tobacco, Peanuts and Sugar Crops: The peanut stocks and processing reports have been expanded so as to obtain information on the uses of peanut butter. This affords reliable data on the quantities of peanut butter going into general household use, into candies, sandwiches and other products. This change was urgently requested by officers of several national associations.

An annual summary was issued which showed revised totals for end-of-month stocks of: Farmers' stock peanuts, and shelled edible peanuts (by types); shelled oil stock, crude peanut oil and peanut meal. Monthly milling operations, production totals and disappearance for all items were also shown.

A new technique was developed for interpreting yield per acre of peanuts and tobacco from reported condition. The principles involved proved to be subject to much wider application than the crops under study and may be used for other crops.

The production totals for peanuts, for the principal types of tobacco, and for the sugar crops, are known each year because of the availability of mill check-data or sales data. This makes it necessary to re-analyze all data in the light of known production, in order to determine more accurately the acreage changes that took place and the yield per acre that was actually harvested.







County estimates for acreage, yield per acre, and production (for selected list of "trial" counties), were prepared for flue-cured and burley tobacco and peanuts. These data for tobacco were used by the Federal Crop Insurance Corporation in establishing insurance rates and studying risks in specified counties in producing States.

Seed Crops: The seed reports covered thirty-one kinds of field seeds, and 263 varieties, kinds and types of vegetable seeds. Emphasis was put on consolidating subject matter and making fewer, but more comprehensive reports for release. Whenever possible, seed data were included with other larger reports to give as wide distribution as possible to the particular reports. The principal seed reports cover production forecasts, stocks, price and movement, and retail prices and a disposition report for the six major legume crop seeds.

Under the vegetable-seed program, the standard surveys were repeated to provide the Department with the essential data on which to base allocations to foreign nations. These reports were considered invaluable for the conduct of programs relating to disposal of seed, for termination of government contracts with vegetable-seed growers, and other uses in the Department.

The monthly inquiries on kinds and quantities of vegetable seed exported by large seed companies were continued in order to keep in close touch with exports of seeds so that supplies would not be depleted because of more attractive prices offered by foreign buyers.

## (2) Fruits and Vegetables

Fruit and Tree Nuts: The regular estimates covering twenty-one kinds of fruits and five kinds of tree nuts were continued and improved. Fruit and nut crop estimates were made also by States and for a number of crops by varieties and areas and forecasts of production of each of twenty-one varieties of apples. A consolidated report was prepared showing the farm disposition and utilization of sales for thirteen non-citrus fruits, by States, for the crops of 1944 and 1945, together with historic material on a national basis for the years 1934 to 1945.

To keep the estimates abreast of the increasing demand for information on citrus fruits, estimates of oranges in Texas and Arizona were separated by early and mid-season and Valencia varieties. This makes available a comparable variety breakdown of oranges for all citrus States. A report was published also covering production, farm disposition, value and utilization of citrus fruit from 1909 to date.

Assistance was given to the Federal Crop Insurance Corporation in exploring the feasibility of insuring citrus fruits. Production records for nearly 2,000 groves in seven test counties in Florida, California, Arizona and Texas were gathered and analyzed.

A large volume of special work was performed for the Office of Price Administration, Production and Marketing Administration and other Government agencies, such as a special survey of hail damage to California apricots, and of freeze damage to early apples in Delaware and Maryland.

Commercial Truck Crops for Fresh Market: The regular reports covering twenty-seven commercial truck crops on a State and seasonal group basis were continued and a textual summary of crop conditions in each State and for each crop was released twice a month from Washington, D. C., and the thirty-five State offices where commercial truck crops are important.

Special surveys were made for the Production and Marketing Administration to determine crop damage, on which ceiling price adjustments might be made.

Florida vegetable acreages by counties for the years 1935-1944, inclusive, were included in "Vegetable Crops in Florida," a joint publication of this Bureau and the Agricultural Experiment Station and University of Florida. Another popular publication was "Usual Dates of Planting and Harvesting Commercial Truck Crops for Fresh Market."

Truck Crops for Commercial Processing: Reliable statistics on the probable production of truck crops for processing, together with data on prices paid to growers for these vegetables, have been of growing importance both to growers and processors.

Most of the information used as a basis for the estimates of acreage, yield per acre, production and prices to growers was furnished voluntarily by about 2,000 commercial processors, who grow 85 to 90 percent of their vegetables under contract with growers.

Potatoes and Sweetpotatoes: The regular program of work for potatoes and sweetpotatoes was supplemented by estimates of acreage, yield and production of the commercial early segment of this crop in the nineteen early and intermediate potato producing States and two of the late potato States. These supplemental estimates provide a measure of the quantity of new crop potatoes produced for market in the winter, spring and summer crops.

Estimates of potato acreages planted, harvested acreage, yields per acre and production during the period 1929-1944 were furnished the Federal Crop Insurance Corporation, as a special service, for nineteen counties located in eighteen States for use in exploring the feasibility of a potato insurance program.

### (3) Livestock and Poultry

Livestock and Meat Production: The acute need for detailed information on livestock slaughter and meat production during the war years made it necessary for Government agencies to obtain reports from slaughterers who are not under Federal inspection to augment the detailed data that has



been available on plants under Federal inspection. The War Food Administration obtained records covering all of the months in 1944 and the first four months of 1945. In May 1945 the Bureau undertook the tabulation of slaughter data collected by OPA and the preparation of estimates of the number of head and liveweight of the different species slaughtered in non-federally inspected plants. When slaughter controls were suspended, arrangements were made to inaugurate a program of securing the slaughter reports on a voluntary basis and preparing estimates from sample returns. This project started in December 1945. In order to have estimates covering all of the months in 1945, arrangements were made with the Defense Supplies Corporation to tabulate slaughter data reported to them in connection with subsidy payments made to slaughterers. The records of the Defense Supplies Corporation were used for making estimates of slaughter for the period August to November 1945, inclusive. Thus it was possible to have a continuous record of monthly slaughter estimates for two full years, 1944 and 1945. Funds were appropriated by Congress to prepare monthly estimates of non-federally inspected slaughter beginning in the fiscal year 1947.

The Bureau prepared an official report on livestock slaughter and meat production which was released in April 1946. This report will be a regularly scheduled report in the future. Heretofore, total slaughter and meat production estimates were not released until later in the year.

Hogs and Lard: Information published in the June Pig Crop report included for the first time United States estimates of the number of sows farrowing by months for the spring season. Heretofore, only general statements on the time of farrowing were included in the report. The December Pig Crop report will include estimates of fall farrowings by months also, and future plans call for more detail by States and regions. Livestock interests have been keenly interested in obtaining this information.

In connection with the slaughter project it has been possible to begin collecting basic data on lard production. No information had been collected on lard production in non-federally inspected plants except in the case of some of the larger wholesale establishments. The basic data now being collected will permit more accurate estimates to be made in the future on commercial lard production.

The data on number of head slaughtered and average liveweight has provided valuable information for use in connection with the balance sheet, production and income estimates for meat animals which are regularly prepared by the Bureau.

Poultry and Eggs: The program of poultry statistics includes about eighty different reports throughout the year; comprising some 20,000 monthly, seasonal or other periodic State estimates, relating chiefly to numbers of chickens and turkeys on farms and to the production of chickens and eggs, turkeys, commercial broilers, liquid, frozen and dried eggs, and eviscerated and canned poultry. Monthly reports of commercial hatchery operations also make up an important segment of the program.

Continued emphasis has been given to enhancing the usefulness of the whole series of reports, through improved statistical techniques and expanded detail.

New work during the year included the expansion and improvement of the project to collect data showing the weekly chick movement into commercial broiler plants in major areas of concentrated commercial broiler production, so as to furnish almost complete coverage of total broiler chick movement and estimates of total movement were inaugurated during the last half of 1945 and published in weekly State reports.

Data are now being collected on the amount of feed fed monthly to layers on farms. In January 1946 a question on feed fed was added to a monthly schedule going to commercial egg producers. These data will be used in preparing a monthly report showing by States the cost of a farm poultry ration, the amount of feed fed per layer and per dozen eggs and the spread between the cost of feed fed per layer and the value of eggs produced.

#### (4) Dairy Products

During the early part of the fiscal year 1945-46 emphasis continued to be placed upon the collection of dairy statistics for the use of the Office of Price Administration, War Food Administration, Reconstruction Finance Corporation, and the Dairy Products Marketing Association, acting for the Commodity Credit Association, in their respective wartime dairy programs. Funds were provided by the war agencies for this expanded work, which was brought to a close with the cessation of the several control programs.

With the close of the war, the Bureau gave serious consideration to reconversion of its continuing program of dairy statistics to incorporate certain desirable improvements developing out of the more extensive reporting operations for other agencies. Studies were made of the estimating techniques applicable in making quantitative estimates of the current weekly production of Cheddar cheese from sample indications. A procedure was developed for that purpose, and it is proposed that beginning with the fiscal year 1946-47 quantitative estimates will be made each week of the total quantity of Cheddar cheese produced during that period. This will replace the current weekly reports showing percent changes only.

Data on the monthly production of butter, cheese, and evaporated and condensed milk, dry milk products, and other manufactured dairy products in 1945 were collected and released to the public. Data on the production of manufactured dairy products were collected on a joint Federal-State schedule under cooperative arrangements in twenty-seven States. Most of these agreements have been developed within the past few years under the Bureau's enlarged dairy statistical program.

To satisfy the increasing demand for information on the production of ice cream, the Bureau developed a satisfactory formula and beginning with the 1946-47 fiscal year a monthly report on the current production of ice cream was inaugurated.



To meet the need for more detailed information by nutritionists and members of the fluid milk industry on the per capita consumption of fluid milk and cream, the Bureau completed a survey on the per capita consumption of fluid milk and cream in ten cities and three States located in the New England, Middle Atlantic, and South Atlantic Regions. The results, showing variations between the per capita rates of consumption in these several markets and States, are being published. The Bureau compiled data also on the per capita consumption of fluid milk and cream in over 10,000 cities with a population less than 25,000.

During the year State estimates of monthly milk production were prepared for the first time in three additional States--North Carolina, Oklahoma, and Montana--bringing to eighteen the total number of States for which these estimates are made regularly. The State monthly milk production estimates were published with the national report "Crop Production" for the first time in March 1946. Several additional States have progressed materially in their analysis of background data toward preparation of monthly milk production estimates, and it is expected that monthly estimates of milk production in these States will be initiated in 1946-47.

#### (5) Price Statistics

Prices Received by Farmers: This work involves the preparation of the indices of prices received for thirteen groups and subgroups of commodities in addition to the collective index, and the publication monthly of the indices and actual prices of principal commodities in "Agricultural Prices." These prices, used in connection with data from the Prices Paid by Farmers "project," provide the basis for comparing actual prices received by farmers with parity prices as established by law. The data collected under this heading are widely used by both governmental and non-governmental agencies in connection with problems involving farm commodity prices. They also are utilized in preparing estimates of agricultural income.

The regular program of reports continued existing series of estimates by States, market areas, geographic regions, and for the United States on fifty agricultural commodities, by months and on 156 farm products on an annual basis.

Approximately 200,000 county price estimates for 1944-45 were prepared for Bureau of the Census use in evaluating 1945 agricultural census enumerations. The staff assisted in planning the future price coverage of agricultural products at all markets, contributing in large part to the envisioning of an eventual price coverage of all farm commodities and products derived therefrom at every stage of transfer of ownership in local and terminal markets from the time they leave the farm until they are utilized by the ultimate consumer.

The work includes the preparation of the parity index and its publication each month in "Agricultural Prices." Data are collected through the State offices of the service and also by direct questionnaire from Washington. Extensive check data are collected from other agencies, dealers' catalogs, and miscellaneous sources.

Prices Paid by Farmers: On the basis of about 100,000 questionnaires returned by independent merchants and about 6,500 from chain store price correspondents, prices paid by farmers were estimated, by States, for 465 items. The number of returns fell off slightly during the year as supplies in some stores became too scarce to price, but steps were taken to rebuild our price-reporter lists. Publication was continued currently of monthly price indices for family living commodities, farm production commodities, all commodities, feed, and all commodities including interest and taxes. National average prices paid by farmers for 151 of the commodities included in the index were published currently in "Agricultural Prices." Also State average prices for five important feeds, and geographic division average prices for twenty-one clothing and dry goods items were published currently.

A major contribution during the year was the completion and publication of a report on "Poultry-Ration Costs and Poultry-Feed Price Ratios, 1924-45." Heretofore poultry-ration costs were available only on a national basis and the rations used were known to be out of date. A nation-wide poultry-feed survey in 1944 made available the first comprehensive poultry-ration data on a State basis. These data made possible the computation of State poultry-ration costs, and indicated the extent of the shift toward the use of a larger proportion of commercial mash and scratch feed in place of home-grown grains.

Periodic surveys of prices paid by farmers for automobiles and trucks were reinstituted during the year, and the indicated price changes were incorporated in the parity index. Prior to World War II, the automobile price segment of the parity index was based on average wholesale prices, as obtained currently by the Bureau of Labor Statistics, for automobiles and trucks, increased by the amount of Federal excise tax. As the result of price freezes by OPA wholesale prices for automobiles were held constant from December 1941, and for trucks from June 1942 to early 1946, and by the end of June 1946 the Bureau of Labor Statistics had not yet reinstituted its series of wholesale prices.

#### (6) Special Farm Statistics

Farm Labor: The regular monthly Farm Labor Report on farm employment and farm wage rates has been expanded to include special monthly data on total replacements and veteran placements prepared by the Extension Service, and monthly reports on numbers of foreign workers and War Prisoners employed on farms and specific wage ceilings from reports of the Production and Marketing Administration.

An increase in appropriation made possible a nation-wide farm wage and employment enumeration in September in a sample of 158 counties. A preliminary report was published in the December Farm Labor Report.

Enumerations to secure wages and hours worked in special crop areas and labor centers were continued from the previous year. As part of the special wage project, arrangements were effected to secure a random list of 150,000 farm operators from the 1945 Census lists, which has been utilized in gathering data on farm labor statistics.

Survey of Agriculture: The Quarterly Enumerative Survey of Agriculture of a 2,500 farm sample in 101 selected counties, started in April 1945, was continued with enumerations in July and October 1945 and January 1946. Data relating to current farming operations for an entire year were obtained.

Workload Data: In general the 1948 budget is based on the estimated time it will take technical men and clerks to perform the work involved in the program together with travel and other necessary expenses.

In most cases the work planned in 1948 is merely a continuation of existing activities although there may be adjustments in questions on schedules already in use. The following table represents a comparison of the number of inquiries, etc., for past years and proposed in 1948:

COMPARISON OF CERTAIN WORK-LOAD DATA  
Fiscal years 1945, 1946, and estimates for 1947 and 1948

	: Fiscal : year : 1945	: Fiscal : year : 1946	: Fiscal : year : 1947	: Fiscal : year : 1948
Separate inquiries mailed to :				
farmers and others :	9,253	9,400	9,500	9,500
Copies of schedules distrib. :	8,259,648	8,325,000	9,800,000	9,800,000
Schedules tabulated :	2,102,859	2,200,000	2,600,000	2,600,000
Questions per schedule (ave.) :	22	22	20	20
Reports prepared :	4,129	4,400	4,500	4,500
Copies of reports distributed :	6,663,010	6,750,000	6,900,000	6,900,000
Printed releases distributed :	2,556,655	2,700,000	2,900,000	2,900,000
Special inquiries ans. by mail :	22,040	23,000	28,000	28,000
Special inquiries answered :				
by telephone :	31,938	33,000	35,000	35,000
Person interviews (exclusive :				
of enumerations) :	15,431	16,000	17,000	17,000
Special county estimates :				
prepared :	386,450*	250,000	260,000	260,000
Miles of travel within State :	704,312	850,000	1,000,000	1,000,000

\* Includes 200,000 Census county price estimates.

The current statistics compiled by the Bureau on crops, livestock products, agricultural prices, farm employment and the other related subjects are based mainly on sample data obtained through mail questionnaires. The collection, analysis and interpretation of the data is largely a decentralized operation through 41 field offices, each in charge of a qualified



statistician of long experience. Most of these offices are concerned with the work for one State only, the notable exception being the New England office (6 States). In 29 of the offices (including the New England office at Boston), the work is performed in cooperation with appropriate State governmental agencies (involving 25 States) or State Colleges (8 States). The basis information used in preparing most of the primary statistics is obtained from reports made by approximately 750,000 farmers and other well-informed individuals, who are representative of every agricultural county in the United States and who report on one or more items during the year.

Every month of the year a general schedule goes out from each of the forty-one field offices, the inquiries varying with the season. Approximately 900,000 copies of this general schedule are distributed over the twelve-month period. The July general schedule, for example, contains about fifty questions and covers crop conditions, production of certain crops for previous years and information on dairy and poultry products, farm labor, wage rates and farm land value. From July to December other special monthly schedules are also sent out in the nineteen cotton producing States. Schedules for prices received and paid are sent out each month. The most extensive of the data gathered from mailed questionnaires are the acreage surveys, including mailings of 280,000 questionnaires in March, 375,000 in June, and 670,000 in September, and the livestock surveys which include mailings of 610,000 questionnaires in June and December of each year.

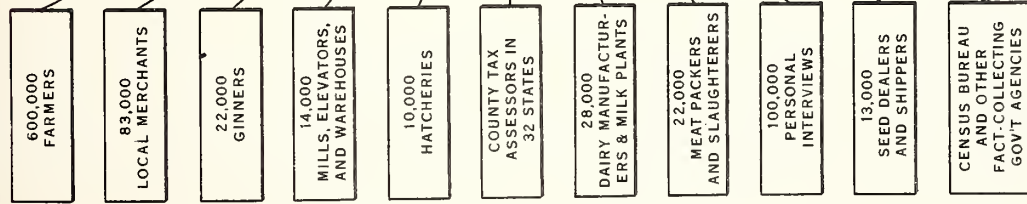
The information obtained from mailed questionnaires is supplemented by data from many other sources, such as State Assessors' enumerations of agricultural information, crop meter frontage measurements, carlot shipments, warehouse receipts, data available through various governmental action programs or regulatory activities, local surveys by personal visit to selected farms, personal travel and observations by field statisticians, as well as reports periodically secured from other sources having a knowledge of farming, agricultural production and processing. A great many special reports are required on specific problems throughout the year, such as reports on damage from freeze, floods, hurricanes, etc. Most of the latter are usually made following an immediate personal inspection by experienced field statisticians.

The following chart shows how information flows through the Bureau's statistical organization from the sources to the people who use it.

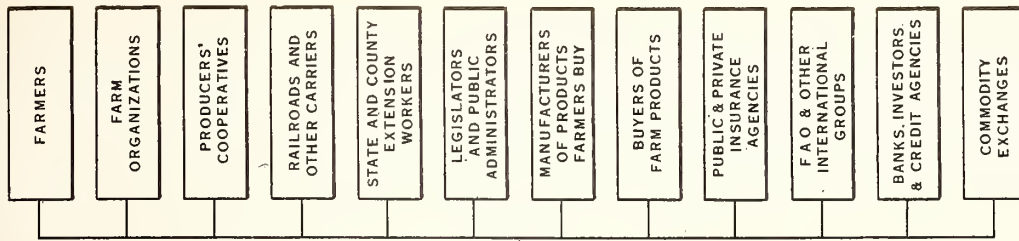


# AGRICULTURAL ESTIMATES OF THE BUREAU OF AGRICULTURAL ECONOMICS FROM SOURCES TO USERS

## SOURCES



## USERS



*This chart shows how information flows through the Bureau's statistical organization from the sources to the people who use it. The government's official agricultural estimates are based on reports from a cross-section of farmers and people who do business with farmers. They are checked against the complete enumerations made every five years by the Bureau of the Census, and against the reports of buyers, processors and*

*carriers of farm products, whose operations are a measure of farm production. Besides their immediate usefulness to farmers and the general public, these estimates provide basic data required for analysis of farm income, prices, costs, parity price determinations, and prospective demand and prices for farm products.*



STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Special Research Fund, Department of:			
Agriculture (Bureau of Agricultural Economics): For special research on economic factors affecting the farm industry ...	60,728:	65,800:	65,800
Working Funds, Agriculture, Bureau of Agricultural Economics, Advances from:			
Department of Agriculture:			
Survey of expenditures of farm operators families (Bureau of Human Nutrition and Home Economics) .....	17,969:	31:	- -
Conducting field work, on a survey of 400 households in the State of Vermont for the purpose of evaluating the extension work in that State (Extension Service) .....	5,000:	- -:	- -
Analysis of the principles and methods for economic evaluations of proposed flood control programs (Forest Service) .....	- -:	8,000:	- -
Total, Department of Agriculture .....	22,969:	8,031:	- -
Bureau of the Census: Statistics on prices received by farmers for specified agricultural products, farm value, and other data .....	16,202:	13:	- -
Planning and developing new methods of procuring agricultural data .....	2,500:	26,023:	- -
Total, Bureau of the Census .....	18,702:	26,036:	- -
Interior Department: Study of the development of food products industries in the Columbia Basin .....	13,934:	16,366:	- -
Study of land and water resources of the Missouri River Basin .....	18,263:	737:	- -
Total, Interior Department .....	32,197:	17,603:	- -

(Continued on next page)

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
<u>Working Funds, Agriculture, Bureau</u>			
<u>of Agricultural Economics,</u>			
<u>Advances from: Cont'd</u>			
<u>Treasury Department: Studies of:</u>			
the effectiveness of the			
various methods of selling			
war bonds and factors affect-			
ing the sale of bonds and			
related information .....	33,691:	35,292:	--
<u>War Department: Punching and</u>			
sorting cards for Morale			
<u>Division, Strategic Bombing</u>			
<u>Survey .....</u>	2,408:	92:	--
<u>Study of veterans readjustment:</u>			
to civilian employment for			
quartermaster's service .....	1,715:	33:	--
Total, War Department .....	4,123:	125:	--
<u>National Housing Agency:</u>			
Participation in housing			
mission to the Philippines ..	3,827:	673:	--
<u>Federal Reserve System:</u>			
National Survey of individual			
holdings of liquid assets ...	52,128:	7,872:	--
<u>Office of Price Administration:</u>			
Collecting and analyzing			
statistics on dairy products	39,253:	233:	--
<u>Federal Communications</u>			
<u>Commission:</u>			
Study of the problems of			
radio program service to			
rural areas .....	23,920:	29:	--
Total, Working Funds .....	230,810:	95,894:	--
<u>Miscellaneous Contributed Funds,</u>			
<u>Department of Agriculture (Bureau</u>			
<u>of Agricultural Economics):</u>			
Trust fund deposited by the			
following cooperators:			
<u>National Bureau of Economic</u>			
<u>Research: Cooperative study:</u>			
of agricultural financing	2,135:	5,365:	2,500
<u>City of Bridgeport: Postwar</u>			
planning study, Bridgeport,			
Connecticut .....	84:	--	--
<u>Iowa State College:</u>			
Cooperation with Iowa State			
College on research and			
statistical methodology .	6,000:	6,000:	--
Total, Miscellaneous			
Contributed Funds ...	8,219:	11,365:	2,500

(Continued on next page)



Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Penalty Mail Costs, Department of Agriculture (Allotment to Bureau of Agricultural Economics): For			
cost of penalty mail pursuant to:			
Section 2, Public Law 364, 78th			
Congress .....	241,323:	300,000:	364,000
Cooperation with American Republics (Transfer from Department of State): For intern training of			
agricultural economists from			
other American Republics and			
consultive services <u>a/</u> .....	27,424:	43,394:	90,304
Defense Aid--Lend-Lease: Furnishing:			
to the Commodity Credit Corpora-			
tion production and stocks reports:			
on specified farm products <u>b/</u> ..	56,840:	- -:	- -
United Nation Relief and Rehabili-			
tation Administration: Estimating:			
livestock slaughter at non-			
federally inspected points and			
supplying special statistics <u>b/</u>	47,477:	893:	- -
TOTAL, OBLIGATIONS UNDER			
SUPPLEMENTAL FUNDS .....	672,821:	513,346:	522,604

a/ Schedule for this item appears in the State Department chapter of the Budget.

b/ Schedules which include these funds are carried in a separate chapter of the Budget.



OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Objective: To deal effectively and promptly with the vast range of foreign problems, which are both in the field of commodities as well as agricultural policies, of significance to the agriculture of the United States.

The Problem and its Significance: The Office is engaged in assembling, collating, and analyzing information on agricultural developments throughout the world, with emphasis in the fields of agricultural policies as well as commodity production and marketing.

This Office is responsible for keeping the Department, the American farmers, and other interested groups and individuals currently informed on developments in foreign countries which are of significance to American agriculture. In order to give appropriate effect to our policy of international collaboration as required through commitments by the Congress and statements by the President, this information must be sought out and analyzed for the benefit of American agriculture as well as the world agricultural picture generally.

The principal method of accumulating facts on foreign agriculture is through the United States Foreign Service whose agricultural as well as other officers make over 3000 reports each month to this Office. From time to time additional specialists are sent abroad to seek out facts on specific commodity developments and problems with particular reference to the reestablishment of foreign markets for the products of American agriculture. The end of the war found agricultural production seriously disorganized in most of the world. In some areas the war had practically wiped out the production of some commodities; in others it had stimulated drastic (and often-uneconomic) shifts. Stocks of some commodities, like wool, had been accumulated; stocks of others, like fats, had been depleted. Moreover, governmental and trade information sources had been disrupted. This made the fact-finding job of the Office all the more difficult at a time when the United States was faced with joint-international action in allocating world food supplies. As the world emerges from the present period of shortages into more orderly production patterns, the need to keep informed of developments will not diminish. Studies must be resumed in order to provide current factual agricultural data to support the United States position in international discussions leading to international commodity arrangements and agreements. We will, for example, wish to learn the condition of fats and oils, bread and other grains, livestock and livestock products and other food industries in order to determine the extent that new competitive areas may develop and that surpluses in these commodities may be utilized with the most beneficial effect to American agriculture and to the world as a whole. If the United States is to keep informed on factors influencing its position in world agriculture, it is highly essential that an agricultural intelligence service be maintained to achieve that purpose.

Plan of Work: During the past few years much of the work has been performed by a relatively small staff steeped in the knowledge of the agricultural systems of individual countries or in an understanding of world market conditions of a given commodity. This wealth of foreign agricultural knowledge has proved invaluable; also, a great deal of data and economic information have been compiled relating to the world agricultural situation.

This is being brought up-to-date and expanded. The aim of the Office is to maintain an experienced, specialized staff able to cope with the constantly shifting world agricultural scene. This requires occasional foreign travel by specialists to obtain current facts needed by United States agriculture. The work is conducted primarily through a Commodities Branch and a Regional Branch.

International Commodities: The Office obtains and analyzes current data on all important agricultural commodities throughout the world, and prepares reports concerning agricultural production in foreign countries. These reports are prepared to inform United States agricultural interests--producers, dealers, consumers--of world-wide developments with respect to all agricultural commodities. Some of these, such as cotton, are commodities which the United States exports in volume and the domestic price of which is determined by the world price. For some commodities, such as dairy products, foreign trade is small in relation to United States production, but United States prices are important in establishing world prices. For still other commodities, such as coffee, the United States market is dominant.

The needs of all these varied interests require timely statistical and analytical information of a comprehensive and authoritative nature. Much of the information, particularly that relating to the current situation, originates in the Foreign Service offices of the United States located in all parts of the world. The Office regularly assembles and records the information constantly being collected, supplementing it with data obtainable from official publications and agricultural, trade, and scientific publications of other countries. It currently analyzes and interprets the information concerning foreign competitive production from the standpoints of American consumer requirements and United States economic cooperation with other countries. Through publications, correspondence, discussions, and reports, this information is disseminated to American farmers, farm groups and agricultural colleges, as well as to other bureaus of the Department and other agencies of the Government.

In addition, information is assembled on stocks, prices, trade and consumption of agricultural products in foreign countries, and information is analyzed from the standpoints of demand and marketing opportunities for American agricultural products abroad, as well as from the standpoint of competition. This information is also disseminated currently.

Basic studies are conducted of agricultural commodity production, production methods and costs, market requirements, marketing policies, methods and costs, trade and trade policies, and consumption in foreign countries with particular attention to shifts and trends in production, trade and consumption and their causes. In response to urgent requests from major farm organizations for verified information, it is planned to assign specialists in a few major commodities to make specific commodity studies abroad, and to prepare special reports for policy guidance as well as reports for distribution to interested persons and organizations, both within and without the Government.



Specially qualified personnel are utilized throughout the Government for technical service to many agencies, including the International Emergency Food Council, the Production and Marketing Administration Commodity Branches, and for committee work in connection with the Reciprocal Trade Agreements Program and Special Commodity Agreements, such as the International Wheat Agreement; also, members are utilized on international wheat, cotton, tobacco, and fruit committees, and on the Production Goals, Agricultural Outlook and Post-War Agricultural Committees of the Department.

From an organizational standpoint, the international commodity work is divided as follows:

- Cotton
- Fats, Oils and Rice
- Fruits and Vegetable and Sugar
- Grain and Seed
- Livestock and Wool
- Tobacco and Tropical Fruits

International Area Investigations: This work is concerned with international economic problems and policies in agriculture. The Office assembles, analyzes and interprets data on agricultural policies and programs in every foreign country; evaluates the information obtained through official and other foreign sources, especially from the expanded State Department foreign reporting facilities. It prepares reports and recommendations on agricultural price policies and programs, tariffs and trade barriers, balance of payment problems, credit arrangements and other international or regional arrangements, competition and trade, and on cooperative and economic policies affecting United States agriculture. Over a period of years there has been built up an expert staff, familiar with the agriculture of the various countries and skilled at keeping in touch with economic developments abroad through the reports of the foreign service of the United States, periodical and other source material in the language of the country concerned, published secondary materials, contact with competent observers returning from foreign countries, and occasional assignments in the countries concerned to renew and keep up-to-date their extensive first-hand knowledge of the agriculture in those countries. This task is basic to the work of the Department, and to the foreign agricultural relations of the United States.

Policies and programs of some countries tend to expand domestic production and reduce imports as well as to curtail the opportunity for United States exports. Policies affecting production, consumption and exports of our principal competitor countries determine in large part the competition which will face American agriculture.

The staff plays a key role in the Trade Agreements Program of the United States, as well as in other foreign relations involving agriculture. Also, representatives of the Office serve on, and supply current data to, such important official inter-department groups as the Trade Barrier Committee, Commodity Problem Committee, Committee on Foreign Trade Statistics, Inter-Department Committee on Trade Expansion, Committee on State Trading, Occupied Areas Committee and Subcommittees, etc.

Specifically, the Office will continue to:

- (1) Furnish necessary background information and current analyses on world agricultural programs and policies against which can be formulated a national policy in the field of trade barriers affecting agricultural products, international agricultural credit for foreign countries, agricultural labor in foreign countries, and similar matters;
- (2) Cooperate with the permanent Food and Agriculture Organization in the development of plans for world agriculture;
- (3) Analyze foreign food and agriculture developments, and international trade policies, programs and payments as they relate to agriculture, and make available to the United States Government and to the public at large, conclusions which affect American agriculture;
- (4) Measure statistically the changes in food production in foreign countries since the conclusion of the war;
- (5) Prepare studies of basic trends in foreign agricultural production and trade in relation to competition with and demand for American farm products;
- (6) Analyze economic and geographic data and prepare analytical maps and charts, country by country, for the purpose of summarizing and classifying the results of the work.
- (7) Prepare an Atlas on the agriculture of Europe, the Soviet Union and Middle East to provide a basis for determining production, trade and consumption of agricultural products as a guide to determining the competition with and demand for the products of American agriculture.

From an organizational standpoint, the work is divided as follows:

Europe, Soviet Union and Middle East  
Far East  
International Economic Studies  
Latin America  
United Kingdom and Dominions

Coordination and Administration: Much of the work in the field of coordination does not lend itself to the reporting of specific progress. Coordination of the Department's activities in the foreign field is a continuous task involving the maintenance of working relations with the various agencies of the Department as well as with the State Department and other Government agencies which have an interest in foreign economic developments. The new Foreign Service Act of 1946 places numerous new responsibilities on the Department of Agriculture and these are in large part discharged by the staff of the Director's Office. The general administrative operations, such as Administrative Services, Personnel, Budget and Fiscal, have increased considerably during the past few years because of the expanding area of work in which the Office is engaged.



Among other activities, the Office is responsible for much clerical work in connection with all foreign travel of Department of Agriculture officers, and for handling numerous foreign agricultural visitors to this country.

Informational Activities: The information gathered and analyzed by the Office is disseminated to Government and commercial agencies, research and educational institutions and the general public through the medium of authorized publications, the size and free circulation of which have been rigidly limited during the past few years. It is planned that the following regular publications will be continued and expanded: A weekly edition of Foreign Crops and Markets, the circulation of which had previously been restricted to certain war agencies requesting it; Foreign Agriculture, monthly; and Agriculture in the Americas, monthly. Also special bulletins such as "The World Food Situation" are published irregularly as circumstances require.

Specific Accomplishments:

1. A Foreign Crop and Livestock Statistics Committee has been established to insure thorough consideration of all available data, and a synchronized program or series of world commodity summaries and reports has been started.
2. Commodity studies on foreign agricultural production and trade trends are being emphasized. To meet the increasing demand for information concerning export prospects for fruits, a world citrus report and similar reports on fruits and nuts have been issued. A world rice situation report has been published which brings up-to-date all available information on production and trade. Summaries of world livestock numbers give new information on prospective supplies and markets for cattle, hogs and sheep. Other commodity reports will appear as data are available and as conditions change.
3. The United States emerged from the war with its cotton surplus problem intensified by economic disorganization in many consuming countries. In conjunction with the major producing countries an International Cotton Advisory Committee has been called into session, and the Office supplied data for a thorough study of the cotton problem. It is felt that joint action may do much to prevent chaos in the cotton industry.
4. The Office assisted in the formation of a National Horticultural Council to concern itself with the development of markets for American fruit in the foreign field.
5. During the period marked in general by food shortages, the Office provided data to the Combined Food Board and its successor International Emergency Food Council, on world food supplies and participated in developing formulae for equitable food distribution. Shortages of some foods such as fats and oils, meats and sugar will likely continue for some time. In the case of other products, surpluses are impending which will pose problems fully as serious, and the Office will continue to be the reliance of the Commodity Branches of the Production and Marketing Administration in matters pertaining to foreign agricultural production, supply, consumption and trade.

6. In the field of international cooperation, the Office played a major role in staffing and preparing material for the joint consideration of representatives of the United States-Mexican Agricultural Commission for 1946. It also participated in the work of the Interim Commission in preparation for the inaugural conference in Canda of the United Nations Food and Agriculture Organization. The Office has been providing information on the international food situation on the basis of which this organization has been able to effect considerable progress.

The Office played a major part in the formulation of the proposals for the expansion of trade and employment published by this Government in December 1945. In the subsequent elaboration of those proposals in the form of a suggested charter for the projected International Trade Organization, a member of this Office was sent to London as a delegate to the Preparatory Commission for world conferences at which this charter was agreed to in substance by 18 nations. The Office is continuing to contribute to the work of preparing for the conference which will be held next year.

7. A series of studies of the agricultural policy of key foreign countries has been made to serve as a basis for the formation of the agricultural phases of the foreign economic policy of the United States. Members of the Office have participated in inter-departmental deliberations on this subject as the advocate of the American agricultural industry.

8. Changes in food production in various countries have been measured and a compilation has been prepared showing the world food situation at the present time. This serves as a basis for the determination of food policy during the transition of food management to peacetime conditions. At the time of V-E Day a food situation report was prepared which covered the European area; in September a world food situation report was prepared covering the world agriculture at V-J Day.

9. Handbooks prepared for the Army and Navy on the agriculture and food resources in the Axis areas, and used by the armed forces in areas of operation are being used by military governments. In addition to materials prepared in prior fiscal years, Handbooks and Civil Affairs Guides have been supplied for Formosa, Japan, Japanese Mandated Islands, Korea, the Philippines, Austria, Hungary and the Netherlands. Assistance continues to be given the Military Government organization in the form of conferences, lectures and the supplying of material to help in training Military Government officers going to the Pacific.

10. In view of the continued seriousness of the world food situation the Office prepared for publication, at the request of the President's Famine Emergency Committee, three monthly reports during the late summer and early fall in addition to the World Food Situation 1946-47, released on November 4. Work is also under way on the report to be released in February 1947. Considerable work along this line was done for the military, other civilian agencies of the U. S. Government, and for UNRRA and FAO.



11. Long-time activities traditionally occupying a large share of the work of the Office in connection with the demand for and competition with the products of American agriculture have employed a substantial share of the time of the staff during the current year. These included the assembling, analysis and interpretation of data on agricultural policy and programs in every foreign country; detailed study of the production, trade, and consumption in agricultural products for all countries and publication of a number of special studies in these fields.

12. Much time was allocated to problems in connection with the work of the Committee for Reciprocity Information for which the Office provided the member and the alternate for the Department of Agriculture. With reference to the forthcoming conference in Geneva, several members of the staff are preparing the country material; this same personnel and others have also been representatives of the Department of Agriculture on the country committees now engaged in the trade agreements program and will be active in connection with briefs and public hearings.

13. An important feature of the work of the Office during the current year is the preparation of highly confidential studies on the agriculture and food potentials of practically every country in the world for the War Department. This work is actively going forward with as much rapidity as the many other fundamentally important commitments permit. Several of the Personnel have served abroad in the interests of the United States during the current year including the Chief of the Regional Branch now serving as Agricultural Attache in Sweden. Also, four members of this Branch have been in the Far East in connection with the military occupation or agricultural missions; one is currently engaged in agricultural duties connected with the occupation in Austria and one in Italy, while one member has just returned from the agricultural mission to the Middle East.

14. There is being prepared an agricultural Atlas with accompanying text on the agriculture of Europe, Soviet Union, and the Middle East which will be completed in the near future. This provides invaluable background in determining potential production and utilization of agricultural products in that vast area so important to American agriculture.

#### STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Exportation and Domestic Consump-			
tion of Agricultural Commodities,			
Department of Agriculture (Office			
of Foreign Agricultural			
Relations): For obtaining infor-			
mation on foreign market			
developments and other data			
related to the international			
aspects of the work under			
Section 32 of the Act of			
August 24, 1935 .....	\$38,046:	\$54,157:	\$20,000
(Continued on next page)			

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
<u>Rubber Investigations, Bureau of</u>			
<u>Plant Industry (Office of Foreign</u>			
<u>Agricultural Relations): For</u>			
coordinative, advisory and in-			
formational services in connec-			
tion with development of rubber			
production in the Western			
Hemisphere .....	13,003:	- -:	- -
<u>Cultural Relations with China and</u>			
<u>the Neighboring Countries of the</u>			
<u>Near East and Africa (Transfer to</u>			
<u>Agriculture) (Office of Foreign</u>			
<u>Agricultural Relations): For</u>			
making agricultural surveys in			
China and the neighboring			
countries of the Near East and			
Africa .....	159,000:	- -:	- -
<u>Expenses of Foreign Students,</u>			
<u>Department of Agriculture: Trust</u>			
fund of moneys deposited by			
other American Republics			
pursuant to cooperative agree-			
ments for expenses of foreign			
students while in the United			
States for training in			
agriculture .....	5,140:	- -:	- -
<u>Penalty Mail Costs, Department of</u>			
<u>Agriculture (Allotment to Office</u>			
<u>of Foreign Agricultural</u>			
<u>Relations): For cost of penalty</u>			
mail pursuant to Section 2,			
Public Law 354, 78th Congress .	1,354:	1,850:	2,300

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Cooperation with American Republics:			
(Transfer from State Department):			
For promoting in Latin America,			
through the establishment of			
cooperative agricultural re-			
search and extension centers,			
the production of complementary:			
or non-competitive agricultural:			
products, major attention being:			
devoted to the problems in-			
volved in producing or expand-			
ing the production of cinchona			
(a source of quinine), other			
drug plants, insecticides such			
as pyrethrum and rotenone,			
tropical fibers, cacao, and			
vegetable oils .....	\$ 552,965	\$ 671,829	\$ 711,427
For training in agricultural			
research of trainees from			
other American Republics <sup>a/</sup> ..	- -	16,092	16,731
Total, Cooperation with			
American Republics .....	552,965	687,921	728,158
TOTAL, OBLIGATIONS UNDER			
SUPPLEMENTAL FUNDS .....	769,508	743,928	750,458

<sup>a/</sup> Schedule for this item appears in the State Department chapter of the Budget.





## INTERNATIONAL PRODUCTION CONTROL COMMITTEES

International Wheat Council: Under the provisions of a Memorandum of Agreement an International Wheat Council was formally organized and held its first meeting August 3-5, 1942. Delegates from the five participating countries, Argentina, Australia, Canada, the United Kingdom, and the United States, were officially appointed by their respective Governments.

The Council and its Executive Committee have been functioning as international agencies since that time in accordance with the provisions of the Memorandum of Agreement. Particular attention has been given to price discussions and long-time policies for wheat in the postwar period. All meetings have been held in Washington except the regular August meeting of 1945 which was held in London. In 1946 the membership of the Council was expanded to include representatives from eight additional countries, Belgium, France, the Netherlands, Brazil, China, India, Italy and Denmark. The new Council has appointed a preparatory committee to review the Draft Convention and considerable work is currently being done in this field.

International Sugar Council: The International Sugar Council, established under the International Sugar Agreement, signed in London on May 6, 1937, and ratified by the U.S. Senate on December 20, 1937, is being continued on a skeleton basis. The agreement itself provides generally for the regulation of production and marketing on an international basis. The Council was inactive during the war period, except to meet once or twice a year to extend the termination date of the agreement.

The Council has initiated an exploratory study of the agreement with the objective of early revision of certain of its provisions, and has voted to extend it to August 31, 1947.

It is expected that this Council will be highly significant in post-war adjustments in the international marketing of sugar.

International Cotton Advisory Committee: Activities of the International Cotton Advisory Committee in the fiscal year 1946 may be described in two parts, one relating to the Committee itself and the other to the International Cotton Study Group established in accordance with a resolution of the Committee adopted in its Fourth Meeting in April 1945. In all activities the staff of the Office of Foreign Agricultural Relations has had an important and continuing role.

The Study Group, which was composed of representatives of Brazil, Egypt, France, India, the United Kingdom, and the United States, met first in July 1945 to consider practical means of international collaboration in dealing with world cotton surpluses. A draft agreement was prepared in skeleton form for use in discussion between member delegations and their governments and to serve as a basis for specific instructions. The Group reconvened in January and again in February, 1946, but it was disclosed in these later discussions that no draft of a practical agreement

could be completed without change in the instructions of several of the delegations.

Accordingly, the International Cotton Advisory Committee was called into session on May 7-14, 1946. The Governments of the following countries were represented: Argentina, Australia, Belgium, Bolivia, Brazil, Canada, Chile, China, Columbia, Cuba, Czechoslovakia, Egypt, France, Greece, India, Iran, Mexico, Netherlands, Nicaragua, Paraguay, Peru, Turkey, Union of Soviet Socialist Republics, United Kingdom, United States, Venezuela, and Yugoslavia. The Committee reviewed the world cotton situation and considered the report of the International Cotton Study Group. It concluded that:

1. There should be established an Executive Committee of 12 to serve until the next meeting of the full Committee. The Governments of Argentina, Belgium, Brazil, Canada, China, Czechoslovakia, Egypt, France, India, Peru, the United Kingdom, and the United States were declared eligible to be represented on the Executive Committee.
2. The Executive Committee should
  - a. Create and maintain at Washington a secretariat for the purpose of supplying complete, authentic, and timely statistics on world cotton production, trade, consumption, stocks, and prices;
  - b. Provide a medium for the exchange of views in regard to current developments in the international cotton situation;
  - c. Further develop work on an instrument of international collaboration to deal with the world cotton situation; and
  - d. Establish practical cooperation with the Food and Agriculture Organization and other international organizations concerned with the world cotton situation.

A budget was authorized with a top limit of \$50,000 for the first year, and each member country was requested to make an initial subscription of \$2,500. The Executive Committee was authorized to be organized when 12 member governments has approved the Resolution and made their contributions. The Resolution was before the member governments for consideration and approval at the close of the fiscal year.

International Wool Study Group: Steps are being taken for the organization of an International Wool Study Group to consider the position of wool in international trade.

Several informal meetings have been held in London and in the United States concerning this commodity and on September 30, 1946 the United Kingdom Government issued invitations to the governments of 13 other countries interested in production, consumption, or trade of apparel wool to participate in international wool talks in London November 11-16, 1946. The United States accepted this invitation in a memorandum dated October 16, 1946 and communicated to the British Embassy in Washington the names of United States delegates on November 1, 1946.

Invitations to the talks were extended to the governments of the following 13 countries: Argentina, Australia, Belgium, Canada, China, France, India, Italy, New Zealand, South Africa, United States, USSR, and

Uruguay. All of these governments, except the USSR, accepted and were represented in the talks. The Department of Economic Affairs of the United Nations Organization was represented by an observer.

From the United States viewpoint, interest is principally three-fold: (1) Maintenance of domestic production is important from the standpoint of international security, (2) the requirements of consumers and the possible production of other fibers have an important bearing on policies decided upon internationally, (3) the sheep and wool industry is of primary importance in western United States.

Wool is important in international trade because of the very large stocks existing throughout the world and several governments now participate in an agency established for the purpose of handling large stocks and the marketing of new clips. The United States, through the Commodity Credit Corporation holds large stocks of domestically produced wool.

Current plans indicate that a more formalized international wool organization will be established at meetings in Geneva sometime in April. The United States will be represented at Geneva and is expected to participate in the world organization on a permanent basis.





## EXTENSION SERVICE

### (a) Payments to States, Hawaii, Alaska and Puerto Rico

General Plan: The traditional job of the Cooperative Extension Service since it was authorized by the Smith-Lever Act in 1914 has been education through practical demonstrations and furnishing information. The Federal, State, and county governments cooperate in financing the employment of county extension agents whose work it is to demonstrate and otherwise carry useful information to farm people on their farms and in their homes. This information emanates primarily from the vast research of the United States Department of Agriculture and the State Experiment Stations as well as the experience of the most successful farmers and farm homemakers. Increased food production and conservation, higher incomes, improved standards of living, and better nutrition and health are brought about through using more efficient and economical methods of production, marketing, utilization, and homemaking.

Each of the 48 States and the Territories of Hawaii, Alaska, and Puerto Rico has a director of Extension, a State administrative and supervisory staff, with headquarters in most cases at the State agricultural college; and county agricultural agents, county home demonstration agents, and assistant county or 4-H Club agents, who have their offices usually at the county seats. With its State and county workers, and volunteer farm men and women leaders in the communities and neighborhoods, Extension reaches in a personal way about 80 percent of the farm families in the United States.

Objective of Cooperative Extension Work: The activities of the entire cooperative extension organization in Washington and in the 48 States, Alaska, Hawaii, and Puerto Rico, are directed toward the -

1. Improvement of the economic, social, and spiritual well-being of the farm family.
2. Improvement of farm income through the application of science and farm mechanization.
3. Improvement of the health of all people through better nutrition and more adequate health facilities and services.
4. Improvement of family living through better housing, rural electrification and more adequate labor saving equipment.
5. Improvement of educational and recreational facilities for the home and the community.
6. Development of a better understanding of and more effective participation in community, State, national, and international affairs to the end that constructive policies may be determined.
7. Conservation of resources so that future generations may also have adequate nutrition.

The Problem and its Significance: Changes and adjustments are constantly taking place in all phases of farming and home life. Because of the confidence rural people have gained in their cooperative county agents through many years' experience with food production, conservation and other co-

operative extension programs, Federal, State, and county extension workers are receiving more and more requests for assistance in the activities of rural people. Extension workers are confronted with basic long-time problems, such as public policies, prices, maintaining the peace, etc., all of which have a continuing aspect and long-time import as well as immediate problems such as post-war production adjustments in crops and livestock - the maintenance of adequate levels of farm income - the effect of farm mechanization on farm life - the need of aiding rural people in determining the best use of idle lands and forests, - the need of new techniques for expanding balanced farming - the return to farms of veterans who will need assistance - the demand for more effective help with such problems as housing, nutrition, health, rural electrification, and home conveniences by rural families. These, and many other problems are today making the work load of the extension worker extremely heavy.

Examples of Current Activities: Approximately  $7\frac{1}{4}$  million families in this country, Alaska, Hawaii, and Puerto Rico received educational assistance from extension workers last year. Satisfying the farm need for facts, new ideas and skills, took over  $3\frac{1}{4}$  million farm and home visits by extension workers, also 700,000 news articles, 42,000 radio broadcasts and 20 million bulletins and circulars. It involved 10 million office calls from farm people and attracted over 35 million people to meetings, demonstrations, tours, and other extension sponsored gatherings. The material covered by this mass teaching effort ranged from conservation of the soil to the salvage of left-over foods or worn-out clothing. It touched almost every crop, insect, disease and parasite. It included the construction, operation and repair of buildings and equipment. It reached over  $1\frac{1}{2}$  million boys and girls in 4-H Clubs and 1,100,000 women in homemakers' clubs.

The Business Side of Farm and Home: 1,100,000 farmers and homemakers obtained help from extension workers last year in analyzing their farm and home plans, setting up improved procedures or seeking additional sources of income. Discussions on the economic outlook have helped half a million other farmers and homemakers to plan the year ahead, to estimate their income and weigh the payment of existing debts against the risk of expanding their operations. Returning veterans have used economic information also. Many of them have gone to the county agents for advice about land values, credit sources, credit dangers, successful farming methods, and local opportunities to buy or rent, or to work and farm part time. Community problems such as land use, flood control, roads, schools, rural health and taxes are samples of subjects that have been tackled and decided by State and county rural policy committees. Extension has helped set up and worked with these committees in over 10,000 communities.

Home Demonstration Work: Home demonstration work is a judicious combination of group and individual work, of campaigns and home visits, of formal meetings and conversations, of direct teaching and missionary work. All this passes knowledge on to community leaders who in turn pass along what they learn in ever-widening circles.

It takes over 8,500 pounds of food to feed a family of 5 over a 12 month period. Milk, fats, lean meat and tomatoes, green and leafy vegetables, potatoes and other vegetables, citrus, and other fruits, flour and cereals, eggs, dried beans and peas, sugar -- all are essential to an adequate healthful diet, and the total amount for an average family for a year weighs more than 4 tons. Helping families to budget their food



needs, produce that food, and obtain the most meals from these home grown products is a major job of extension workers. Nearly one million families were helped with food budgets alone during the year. Eighteen million home gardens were planted last year producing approximately 8 million tons of fresh vegetables. Orchards and berry patches added heavily to the total. A survey indicates that over 3 billion quarts of food were preserved at home. Over  $2\frac{1}{2}$  million pounds of beef, pork, and lamb were dressed last year by farmers on the farm largely for home use. Over  $2\frac{1}{2}$  million families were helped with the preservation of home raised food during the year.

4-H Clubs: The purpose of 4-H Club work is to teach rural boys and girls some of the improved methods of farming and homemaking and to combine these skills with lessons in thrift, integrity, perseverance, dependability and good citizenship. This work crosses and mingles with all other extension activities but chief emphasis for 1946 was on food production and conservation for the benefit of those at home and overseas. The half million acres of crops, 700,000 4-H animals, 10 million chickens, 33 million quarts of canned food, 13 million pounds of other food - frozen, dried, cured or stored, the 19 million well-planned meals and over  $1\frac{1}{2}$  million home made or remodeled garments - all these added extra food and clothing for a world that needed more. 4-H Clubs and club members also shouldered their share of the responsibility for community activity in health, safety and recreation.

Rural Health Program: Extension has always included health in its educational and 4-H programs but emphasis has been on nutrition, home situations and health habits rather than on medical care. Recently Nebraska, North Dakota and Ohio added health specialists to their State extension staffs and Arkansas and Maine are about to do so. The work is expected to increase. The job of these specialists will be to help communities survey and analyze their health needs; appraise and use their local medical facilities to best and widest advantage, and work out with them the programs that seem practical and adequate. Authorities are agreed that there should be one doctor to every 1500 people as the very minimum, yet many rural areas have only one doctor for 2,000 to 10,000 people. According to the most recent records, 1,200 rural counties have no recognized hospital at all, yet they contain a population of 15 million.

Rural Organization and Leadership: In 2,000 counties extension workers helped 42,000 community groups to organize or proceed with programs to improve the social life of all the neighbors. Better recreational facilities were the objective in 26,000 communities and over 450,000 families were assisted with home recreation. Help was given in fixing up 6,600 school or community playgrounds, and 5,700 local libraries received extension assistance. In 24 States where specialists in sociology were employed, assistance was given in community planning, in labor recruiting, housing and training, in war and Red Cross drives. They have helped to train local leaders for subject-matter demonstrations and for conducting discussion groups on local and international policies on health and housing. All extension work aims toward a high level of rural living. The sociology specialists and 100,912 local leaders in recreation and community cooperation are adding momentum to achievement of this end.

Helping farm people to obtain the facts and skills needed to operate their farms and farm homes is extension's assignment. In the past, extension has concentrated on making available the information that would help farm people to become more efficient specialists on the farm and in the home.

Recently, however, Extension has made an organized attempt to broaden the scope of its educational program, to survey rural needs, and to provide more help on problems that concern the family more intimately than they do the farm or the farmhouse. Help has been requested in providing more adequate medical service for rural areas, planned recreation, better housing, improved social relationships, community organization, and more local leadership. None of this is new or foreign to extension programs but an effort is being made to increase the emphasis and speed up the process. The more than a million rural men, women, and youth who have already accepted local leadership in various activities reflected the widespread interest in community development. This leadership is a leaven that is spreading its influence rapidly when given opportunity.

Increased extension activities under funds appropriated by Bankhead-Jones Act, section 25, title II of the Act approved June 29, 1935, as amended by the Act of June 6, 1945: Considerable progress has been made in many of the States under the incentive of the funds provided thus far. These funds are authorized for the further development of cooperative extension work in the fields of agriculture and home economics including technical and educational assistance to farm people in improving their standards of living - in developing individual farm and home plans - better marketing and distribution of farm products - work with rural youth in 4-H Clubs and older out-of-school youth - guidance of farm people in improving farm and home buildings - development of effective programs in canning, food preservation, and nutrition. Extension records show that for the fiscal year ending June 30, 1946, cooperative extension workers added by the 48 States and Hawaii total 1,536, as follows:

- 89 County agents
- 695 Assistant county agents
- 74 Negro county agents
- 124 County home demonstration agents
- 237 Assistant county home demonstration agents
- 86 Negro county home demonstration agents
- 133 County 4-H Club agents
- 3 Assistant county 4-H Club agents
- 67 State and district supervising agents
- 28 Subject-matter specialists

A recent survey indicates that 70% of the 695 assistant county agents are devoting 50% or more of their time to 4-H Club work. The present membership is about 1,600,000. There are 10,000,000 rural boys and girls who should be reached by 4-H Club work.

Much of the time of the new county workers is devoted to assisting farmers and their families in farm and home planning, livestock and poultry production, dairying, soil conservation, food production and conservation, marketing, nutrition, and other activities.



Health organization specialists have been added to the staffs of several States. The job of these specialists is to help people in rural communities survey and analyze their health needs; appraise and use their local medical facilities to best and widest advantage and work out with them the programs that seem practical and adequate.

The State extension agricultural engineers have joined in regional movements to develop programs and teaching materials for better farm houses and farm buildings. The extension farm housing work is organized at Federal, State, and county levels to supply educational subject matter suitable for the guidance of farm people in planning and remodeling.

The appropriations authorized and the amounts appropriated under the Bankhead-Jones Act, section 23, title II of the Act approved June 29, 1935, as amended by the Act of June 6, 1945, are as follows:

	<u>Authorizations</u>	<u>Appropriations</u>
1946 .....	\$4,500,000	\$4,500,000
1947 .....	8,500,000	8,500,000
1948 .....	12,500,000	8,500,000 (Budget Estimate)

A statement showing summary of activities and accomplishments of county agents, home demonstration agents, and 4-H Club agents is attached.

# SUMMARY OF EXTENSION INFLUENCE - CALENDAR YEAR 1945

Farms changing agricultural practices . . . . .	4,031,231
Nonfarm families changing agricultural practices . . . . .	1,483,483
Farm homes changing home economics practices . . . . .	2,075,736
Other homes changing home economics practices . . . . .	1,199,597
Farm homes with 4-H Club members enrolled . . . . .	910,569
Other homes with 4-H Club members enrolled . . . . .	253,011
Different farm families influenced by some phase of the extension program .	4,764,885
Different other families influenced by some phase of the extension program.	2,525,161

# Summary of Activities by County Agricultural, Home Demonstration and Club Agents \*

General Activities	Total reported for all lines of work		Reported by home demonstration agents		Reported by club agents*		Reported by county agricultural agents	
	Number	Counties reporting	Number	Counties reporting	Number	Counties reporting	Number	Counties reporting
Percent of time devoted to work with adults ....	68.58)		64.39)		14.30)		77.24)	
Percent of time devoted to work with 4-H Clubs and older youth .....	31.42)		35.61)		85.70)		22.76)	
Percent of time devoted to office work .....	39.94)		39.48)		39.57)		40.29)	
Percent of time devoted to field work .....	60.06)		60.52)		60.43)		59.71)	
Farm or home visits made .	3,375,604	2,969	943,620	2,409	208,838	506	2,242,988	2,941
Different farms or homes visited .....	1,988,694	2,966	603,872	2,407	139,261	505	1,279,049	2,939
Office calls .....	9,853,170	2,959	1,540,702	2,382	178,357	480	8,174,212	2,928
Telephone calls .....	7,770,630	2,959	1,790,320	2,375	233,300	484	5,754,992	2,921
News articles or stories published .....	691,100	2,937	251,110	2,341	34,545	475	421,864	2,900
Bulletins distributed ....	19,902,853	2,954	9,740,870	2,373	905,297	477	9,256,686	2,921
Radio talks broadcast or prepared for broadcasting .....	42,075	1,372	15,616	928	2,209	200	24,483	1,127
Adult leader-training meetings held .....	73,039	2,616	37,381	2,042	521	99	37,027	2,130
Total attendance of leaders .....	1,171,291	2,456	578,987	2,035	10,436	84	599,700	1,973
4-H Club and older youth leader-training meetings held .....	38,094	2,424	16,716	1,649	3,733	385	19,312	1,813

\*Based on Calendar Year 1945 figures.

	<u>Number</u>	<u>Counties Report.</u>	<u>Number</u>	<u>Counties Report.</u>	<u>Number</u>	<u>Counties Report.</u>	<u>Number</u>	<u>Counties Report.</u>
Total attendance of leaders .....	592,522	2,416	240,540	1,640	61,952	378	319,348	1,806
Method demonstration meetings held for adults.	388,882	2,827	282,454	2,334	1,637	107	107,074	2,567
Attendance at such meet- ings .....	5,174,086	2,825	3,889,303	2,328	21,234	107	1,629,222	2,561
Method demonstration meet- ings held for 4-H Clubs and older youth .....	274,742	2,572	175,354	1,982	22,817	411	81,814	1,911
Attendance at such meet- ings .....	5,910,496	2,570	3,380,318	1,978	506,622	410	1,849,377	1,899
Adult result demonstra- tions conducted .....	214,146	2,322	83,431	1,179	1,078	92	128,680	2,140
Meetings held at such re- sult demonstrations .....	47,621	2,114	22,081	1,029	1,008	91	25,303	1,832
Attendance at such meet- ings .....	981,456	2,086	354,369	1,019	29,474	90	604,256	1,814
Adult tours conducted .....	7,337	1,474	1,748	388	71	38	5,636	1,336
Attendance at such tours ..	167,936	1,462	37,665	385	2,005	38	131,034	1,330
4-H Club and older youth tours conducted .....	9,989	1,634	2,328	516	2,109	313	6,139	1,264
Attendance at such tours ..	223,707	1,631	56,913	515	44,970	312	139,721	1,261
Achievement days held for adults .....	5,514	1,683	4,187	1,355	83	27	1,507	688
Attendance at such days ...	731,326	1,680	476,425	1,354	14,818	26	330,708	684
Achievement days held for 4-H Clubs and older youth .....	16,973	2,391	9,690	1,686	2,455	377	7,022	1,921
Attendance at such days ...	2,266,269	2,390	1,104,811	1,685	412,002	377	1,278,239	1,918
Counties holding farm women's club camps .....	375		345		5		51	
Total attendance at such camps .....	23,211	364	20,943	340	282	5	2,880	47
Counties holding 4-H Club and older youth camps ...	2,046		1,364		326		1,566	
Total attendance at such camps .....	199,048	1,903	108,854	1,368	35,339	320	111,873	1,547



	<u>Number</u>	<u>Counties</u> <u>Report.</u>	<u>Number</u>	<u>Counties</u> <u>Report.</u>	<u>Number</u>	<u>Counties</u> <u>Report.</u>	<u>Number</u>	<u>Counties</u> <u>Report.</u>
Other adult meetings of an extension nature participated in .....	292,669	2,850	90,235	2,195	5,039	225	203,293	2,769
Attendance at such meet- ings .....	11,772,326	2,850	3,474,859	2,192	256,005	225	8,454,207	2,768
Other 4-H Club or older youth meetings of an extension nature par- ticipated in .....	163,287	2,601	56,522	1,753	40,172	443	74,217	2,195
Attendance at such meet- ings .....	6,516,835	2,597	2,072,954	1,753	1,623,295	442	3,293,664	2,191
Total of all meetings held by agents .....	1,320,568	2,850	700,405	2,334	79,976	443	569,961	2,769
Total attendance at such meetings .....	35,730,559	2,850	15,796,941	2,328	3,018,934	442	13,744,234	2,768
Adult meetings held by local leaders not par- ticipated in by agents ..	199,462	2,398	138,937	1,825	1,184	46	63,804	1,589
Attendance at such meet- ings .....	3,431,792	2,398	2,099,375	1,824	42,474	45	1,367,310	1,587
4-H Club and older youth meetings held by local leaders not participated in by agents .....	322,658	2,333	127,567	1,579	93,680	340	122,327	1,628
Attendance at such meet- ings .....	4,794,432	2,332	2,191,128	1,578	1,079,445	340	1,866,634	1,624

\*Include a small amount of work in counties without extension agents, reported by State Club Leaders.

(b) Salaries and expenses, Administration  
and Coordination of Extension Work

General Plan: The Federal Extension office functions as an administrative organization for the whole cooperative agricultural extension service. It promotes close cooperation between the Federal Department of Agriculture and the State land-grant colleges in aiding rural people to attain more efficient farming, better homes, and a more satisfactory rural life. It administers the various acts of Congress relating to extension work which involves policies and programs for cooperative extension work, and reviews budgets for State extension activities, projects, plans of work and financial reports to ascertain that Federal contributed and State offset funds are expended in accordance with the applicable laws and agreements.

General supervision is maintained of the work of the large field force which centers in and clears through the Federal Extension Service, in order that national standards and principles in organizing and conducting extension work on the county level will be followed throughout the country. Assistance is given to State extension services by adapting technical subject matter in agriculture and home economics to the needs of rural people and channeling to them through State and county workers, the results of Department research.

Field studies and personnel training activities are conducted to make extension work more effective, and to provide a factual basis for improving procedures and techniques. Visual and information aids which interpret and support the Department's program are developed for local adaptation and educational use by State and county extension workers. The teaching and informational media used include publications, radio, newspapers, circular letters, slide films, photographs, charts, and the like.

Objective: To represent the Department in the administration, through the State agricultural colleges, of the Nation-wide system of cooperative extension work in order that it may function nationally, as well as on a State and local basis, as an effective educational force to help every rural family.

The Problem and its Significance: The Extension Service, as the educational arm of the Department prepares farm people for the many adjustments that must be made and develops, out of extension experience, guiding principles that will be most helpful. Reconversion to peacetime conditions is requiring a large-scale educational effort. The adoption of new methods developed by research must be urged and every effort must be made to aid farmers in producing the appropriate quality and types of products at the lowest possible costs.

Agricultural production, as the basic job of farmers, will continue to require a large proportion of the time of extension workers. Production techniques have always commanded a major portion of Extension's total time and effort; however, greater emphasis is needed on economic problems and public policies; marketing and distribution; social relations, adjustments, and cultural values; farm homes and buildings; the development of a better understanding of the rural health situation and methods of improvement. Greater stress is also needed on conservation of natural resources; farm and home management; and rural organization and leadership development.

Examples of Recent and Current Activities: Activities relating to the Federal administration and coordination of cooperative extension work are described under the following projects:

General Administration and Business Service: Included under this project are the functions of the Office of the Director, Assistant Directors and the Division of Business Administration. The Office of the Director is responsible for the over-all planning and direction of the nationwide system of cooperative extension work, including determination of policies and procedures. Business operations are grouped under the Division of Business Administration and includes personnel, budget, fiscal, and general administrative matters.

Review and Analysis of State Budgets, Projects, and Plans, and Examination of State Expenditures from Cooperative Extension Funds: The staff under this project reviews all budgets and plans of work submitted annually by the States and Territories, as required by the Smith-Lever and supplementary extension acts. Due to the enlarged program assigned to the Extension Service, budgets and more than 1200 plans of work were reviewed in the fiscal year 1946 covering contemplated expenditures of more than \$54,000,000 of Federal and State Extension and Farm Labor funds. Vouchers involving approximately \$42,000,000 of Federal and State offset funds, including payrolls and travel expenses, were reviewed to determine if each expenditure was in accordance with the purpose of the appropriation, limitations placed by Congress, and in line with approved work plans and projects.

Staff members assigned to this project represent the Federal Director of Extension in making the regular review of extension work. It is necessary to make a thorough analysis and appraisal of work under way, to make definite recommendations based on wide experience and knowledge of cooperative extension work, and to advise with State Directors of Extension regarding administrative policies and procedures. The State Directors and members of their staff request and receive assistance in developing better projects and plans of work, designed to strengthen their organization and extension procedure. Marked improvement has been noted as a result of more general use of plan of work outlines developed in the Federal Extension office. Continued emphasis will be placed on having all Extension project plans reflect post war and other necessary adjustments.

Planning and Coordination of State and County Extension Work: The technical staff under this project consists of eighteen members whose chief duty it is to work in a cooperative manner with 703 State extension directors and supervisors on the organization, operation, and coordination of extension work in the 48 States and three Territories. The work involves the effective planning of the program of the subject-matter specialists, county extension workers, volunteer leaders, and various agencies of the state and Federal governments. The staff centers its activities on the work of 8100 county extension agents who are the base of the entire Extension structure. The primary objective is to aid the 8100 county extension agents in the carrying out of an effective educational program, consisting of useful and practical information on subjects relating to agriculture and home economics and to encourage the application of the same.



More specifically, the work falls into four areas:

- (1) Aiding State extension directors and supervisors in the development of State and regional extension programs based on actual situations and needs of farm people, in adjusting budgets and determining type of personnel to carry out programs which reflect significant national, regional, and state situations.
- (2) Assisting the State extension directors and supervisors in improving administrative and supervisory programs and plans by helping them to analyze problems of organization, personnel and program, by planning methods of training county extension agents and volunteer leaders, by bringing to the director and supervisors new developments in extension methods and procedures, and by aiding in the development of unified programs.
- (3) Aiding State extension directors and supervisors by working with Federal extension subject-matter specialists, agencies of the Department and other Federal agencies working in the rural field to the end that there shall be understanding and integration of projected work for the better solution of existing state and area problems.
- (4) Assisting the director of the Federal Extension Service and his staff in development of extension plans and policies by informing them of State situations, problems, and viewpoints, by interpreting Federal Extension and Department objectives, policies and programs to the State extension directors and their staff, by appraising the effectiveness of the Extension program as reflected through contacts with county extension agents and farm people, by acting as leaders of special programs originating on the national level which are to be organized and carried on in the States and by reporting State problems and situations pertaining to the legal instruments of cooperative extension work such as projects, plans of work, budgets and reports.

The field agents of this staff make many contacts with State and county extension personnel and farm men, women, and young people participating in the extension program. This close liaison with the States contributes much to the partnership of the State Colleges and the Department of Agriculture in carrying on cooperative extension work.

Some of the major accomplishments during the past year were:

Administrative conferences for extension directors in each region including an extension administrative workshop in October 1946, at the University of Wisconsin, regional conference of extension supervisors and subject-matter specialists including five workshop-type of conferences for extension supervisors, the development of a report by a National Committee on Home Demonstration Work, the recommendations of which were carried to State home demonstration leaders and directors through regional conferences. Outcomes of this report having a significant influence upon home demonstration work were the National Home Demonstration Week program in May and the development of a pictorial exhibit which is being shown at state conferences, county and state fairs. The bulletin, "The Home Demonstration Agent," is a major contribution to the understanding of the work of the Home Demonstration Agent.



Membership in 4-H Club work last year was 1,562,622. This staff spear-headed the National 4-H Club Week in March 1946, the National Achievement Week in November 1945, and organized and directed the National 4-H Club Camp in Washington in June 1946, and promoted the participation of 4-H Clubs in Rural Life Sunday. As a further development of the plans evolved last year by the National 4-H postwar Planning Committee, members of this staff in cooperation with State club leaders and extension directors, developed a 10-point program for 4-H Club work which is now being adapted to various situations. This staff worked very closely with a committee of State directors and State club leaders in the preparation of a National 4-H Club Health Program.

Farm unit program in Negro work has been developed and a strong live-at-home program and 4-H program for Negro boys and girls has been emphasized.

A prominent part has been taken in the 7-step cotton production program, and in the organization and program of the National Garden Conference and in furthering home garden work throughout the country. Members of this staff have held responsible positions in connection with plans and activities of (a) Youth United for Famine Relief, (b) Interdepartmental Committee on Juvenile Delinquency, (c) Interdepartmental Committee on Nutrition, (d) National Conference on Citizenship, (e) The Extension Program for Missouri River Development.

Members of this staff have assisted the states in giving emphasis to (a) Victory gardens, (b) Home food production and preservation, (c) 8-Point Dairy Program, (d) Farm Safety Campaign, (e) Famine Relief Campaign, (f) Conferences on Rural Housing, (g) assistance to returning veterans, (h) and to general agricultural production and marketing.

While many of the 1946 activities of the members of this staff will be continued in 1947, special emphasis will be placed upon the following in view of changed situations:

Further work with extension directors and supervisors in utilization of ~~Bankhead-Jones~~ funds to meet special problems and needs in counties.

More assistance to State directors and extension supervisors in developing extension procedure and methods in the field of public policy and related problems in the field of social and economic science.

Greater effort in aiding State directors, supervisors and subject-matter specialists in the development of unified county and state extension programs.

Further development of an enlarged program in Home Demonstration Work and a widespread adoption of the 10 guideposts in 4-H club work.

Development of a program in cooperation with the National Committee on County Agricultural Extension, which will aid county agricultural Agents in readjusting their program.

Development of Technical Subject Matter for Use by State Extension Forces.

The subject-matter specialist staff provides State and county extension forces with the results of research and essential information regarding national programs for agriculture. The work is divided under three work projects, as follows:

- (a) Development of Technical Subject Matter in agriculture is planned and coordinated by a staff of subject matter specialists who are responsible for providing the essential technical material and for so organizing it that it can be used effectively by State extension forces. They act as liaison between the various Bureaus and agencies of the Department and are responsible for carrying the results of the research work of the Department to the State extension forces for incorporation in State and county programs. These specialists also collaborate with State specialists in the development of sound programs for the improvement of farm income and living conditions.

The subject matter developed by this staff covers the range of agricultural science and technology of the bureaus of the Agricultural Research Administration and the related production activities of the Production and Marketing Administration together with the farm applications of programs of the Soil Conservation Service, the Forest Service, the Rural Electrification Administration, and relationships with Federal and national programs for Farm Safety and Fire Prevention, and Farm Housing. Specialists are the connecting link between constructive overall programs and their accomplishment. Every program, to be useful, must be converted into action. Ultimately it becomes necessary to plow, plant, protect, harvest, store, and use. Specialists collect and make available the information, methods, and skills with which these program goals can be achieved. Federal specialists are concerned with keeping extension programs ahead of the need of farmers for new information and new technology. They deal with the new and difficult subject-matter problems rather than the routine farm procedures. They make the best findings of research and farming experience in any State available throughout the country wherever they are applicable. They develop State, county and farmer cooperation with national agricultural programs, such as war and relief food production, by clarifying the purposes and means of achievement.

The major activities of this staff are:

(1) Agricultural Production

For National requirements  
For balanced farming operations  
For production efficiency through science, labor, power,  
and equipment

(2) Agricultural conservation

Soil Conservation  
Water utilization and drainage  
Farm forestry  
Wildlife conservation

(3) Farm and Home Improvement

Housing and landscaping  
Farmstead improvement  
Rural electrification utilization  
Safety and fire prevention

Some of the major accomplishments during the past year under the various lines of work are:

Agronomy: Extension work in soils and crops has centered around food and feed production to help meet the needs for livestock and poultry feeds and to furnish the grain needed to ship to Europe and other war-torn countries, with emphasis on the following: Increased production of cereal, legumes and grass; shift in land use from pasture and forage crops to grain; soil testing for lime and fertilizer needs; more judicious use of fertilizers; winter pasture in the Southern States; seed improvement and certification; improved strains of disease resistant alfalfa and red clover; improved strains of wheat; hybrid corn; peanut production.

Horticulture: The extension program in horticulture centered on the production of food - tomatoes, peas, snap beans and sweet corn for processing; dry beans, dry peas for shipment overseas; potatoes and sweet potatoes as a local backlog to insure enough starch foods; garden vegetables and home fruit plantings to help out the home food supply, for use fresh, canned, frozen, concentrated and in other ways. Strong demand for high prices for vegetables encouraged planting of a large acreage. A shift from wheat and cereals to other food, such as potatoes and vegetables on the part of American consumers is necessary. Supplies of vegetables to meet the needs for the coming year are not too certain and canned and fresh fruits are not expected to meet the demand. The major emphasis in the coming year will therefore be (1) commercial vegetable production, (2) commercial fruit production, (3) victory gardening, (4) home fruit gardens, (5) marketing and distribution problems, and (6) farmstead landscaping and improvement as an integral part of the rural housing program.

Plant Pathology: Plant diseases cause losses in yield, quality of crops and deterioration of their products in marketing, transit and storage. Annual losses from them probably amount to well over a billion dollars. The work stressed during the year by State and Federal extension workers included (1) Cereals, (a) Cleaning and treating seed, (b) Disease-resistant oat varieties, (c) Hybrid corn; (2) Fruits, (a) Orchard spray services, (b) New fungicides; (3) Vegetables, (a) Seed treatment, (b) Victory Garden disease problems, (c) Resistant varieties; (4) Potatoes, (a) Custom spraying, organization of potato spray rings, (b) Certification problems, especially ring rot, (c) New fungicides; (5) Tobacco, (a) Seed-bed treatment, (b) Blue mold control, (c) Resistant varieties; (6) Cotton, (a) Seed treatment, (b) Varieties; (7) Peanuts, (a) Seed treatment, (b) Dusting for control of leaf diseases and insect nests; (8) Flax, (a) Seed treatment, (b) Resistant varieties; (9) Other crops and ornamentals; (10) Fungicide dealer contact programs; (11) Trouble shooting and emergency outbreaks.

Entomology: Destructive insects rob us of food and raiment while the beneficial ones add to our supply. The extension entomologists have the unique job of helping the public to destroy some insects and perpetuate others. The annual tribute to insect pests in the United States amounts to about \$20.00 for each man, woman, and child.



- (1) An extensive program in grasshopper control conducted by Government agencies in cooperation with State and local organizations and individual farmers led to the baiting of 2,223,947 acres which protected about 5,980,000 acres of crops. The value of the crops saved was \$29,550,000, or \$28.20 for each dollar spent.
- (2) Through the specialists' efforts Alabama farmers saved an estimated \$3,000,000 by applying calcium arsenate to cotton to control boll weevil. Farmers who sprayed improperly lost an average of \$530.39 per orchard whereas those who followed the extension spray service lost only \$489.45 per orchard.
- (3) As a result of extension programs cattle grub control saved farmers and packers about \$12,000,000 and many pounds of meat and dairy products.
- (4) The Famine Relief Program was further helped by the control of pests destructive to stored grain. Demonstrations will continue to play an important part in the 1946 program. Group work will be encouraged in some of the projects which lend themselves to such action, for example: 7-Step Cotton Program; Cattle Grub and Louse Control Programs; Home fruit and vegetable garden programs; Grasshopper and Hessian Fly Control, etc., where agronomic practices play such an important part; termite control which involves agricultural engineers and foresters.

Animal Husbandry: Despite problems involved in procuring feed, in labor and equipment shortages, and frequently changing national programs affecting the industry, American stockmen and farmers produced a total of 40.2 billion pounds of meat and 387 million pounds of wool in 1945. This was the third highest output of meat on record and only 6 billion pounds below the peak volume of 1943. Extension's contributions to this satisfactory achievement centered around the following objectives: (1) Meeting established production and slaughter goals; (2) Greater use of roughages and minimum use of concentrated feeds; (3) Adjusting livestock numbers to feed resources; (4) Less dependence on commercial sources of feed; (5) Livestock conservation, particularly the saving of larger percentages of young and the control and eradication of disease and parasites; and (6) Selective culling and the use of sires of known ability to increase productivity. Emergency situations receiving special attention were utilization of the soft corn crop of 1945 by feeding it to livestock, and grain conservation practices necessitated by the 1946 Famine Relief Program.

Poultry: The problem confronting the poultry industry for the next year is to retrench and reduce the volume of production to a practical basis without too many financial casualties. The Extension work will emphasize the necessary reconversion development and fit poultry raising into its proper place in agricultural production. This will include improvement in breeding, feeding, housing, management, and marketing for small family flocks, farm flocks or large commercial flocks and encourage and promote the objectives of the National Poultry Improvement Plan, the National Turkey Improvement Plan, and assist in the National conference which involves 47 States. The



Federal poultry specialist will assist in planning and carrying out regional conferences on egg marketing.

Meat and Lockers: Meat extension work covers the production and preservation of an adequate home-raised meat supply. It is part of the family's effort to maintain health and security. As conducted, meat work includes food budgets, providing essential animals, slaughtering, chilling, processing, curing, freezing, storing and using meat. It crosses the fields of livestock and poultry production, economics, engineering, marketing, nutrition, cooking, and health. It often touches the preservation of fruits and vegetables and the control of insects. The specialists in this field assemble the information needed on methods and equipment and makes it available to the State and county workers. This has been done through training schools, meetings, demonstrations, publications, and movies. In some States it has been necessary to train the assigned specialists from knife sharpening upward. In all States most of the county workers, both men and women, need grounding in the fundamentals. This work has been done not only with extension personnel but also with farm people and the managers of local locker and meat curing plants and with their State and national associations.

Dairy Husbandry: 1946 was the third year of Government-industry cooperation in formulating and carrying out a national 8-Point Dairy Program and has been continued in a special effort in cooperation with the dairy industry committees of each State to reach every milk producer with the State's dairy program. It embraces all of the dairy extension projects carried in each State. The eight points are:

- (1) Grow and abundance of high-quality roughage
- (2) Balance your herd with your feed supply
- (3) Keep production records on each cow in your herd
- (4) Practice disease-control methods
- (5) Produce milk and cream of the highest quality
- (6) Adopt labor saving methods
- (7) Take care of your land
- (8) Develop a sound breeding program

Dairy herd improvement associations are organized and supervised by the extension dairymen in each State. Each member of such an association becomes a demonstrator. On January 1, 1946, there were 1,124 associations in operation, with 23,371 herds consisting of 627,878 cows on test. This represents an increase over a year ago of 18.4 percent in number of associations, 9.8 percent in number of herds and 8.8 percent in number of cows. During the year 1,779 sires were proved from records furnished by dairy herd improvement associations. Average production of the daughters of these sires was 380 pounds of butter fat, which is over twice that of the average per cow in the country as a whole. Additional work on dairy cattle breeding was accomplished during the year through cooperation with various breeding associations. On January 1, 1946, there were 336 artificial breeding associations in 29 States, comprising 73,293 herds with a total of 575,477 cows. Compared with a year earlier this is an increase of 75 percent in both number of herds and number of cows.

Soil Conservation: Extension-SCS Conservationists working with Regional Conservators of the Soil Conservation Service and State

Extension Directors aid in (1) facilitating arrangements for the full employment of resources to carry out the State soil conservation program, and (2) assisting with the planning and carrying out of the State soil conservation educational programs in such way as to make maximum use of the resources. Extension work in soil and water conservation is conducted in all States and territories, and in nearly all counties in the United States. Over half of the farm land of the U. S. is now in 1600 Soil Conservation districts which cover 860 million acres and about four million farms. More districts were formed during the past year than in any previous year.

Agricultural Engineering: Emphasis in shifting from wartime to peace-time agricultural engineering activities includes any and all practices that increase the efficiency of production with less cost and less drudgery, and that would make the farm homes better places to live. Major phases of the work of this project are:

- (1) Farm structures and housing
- (2) Farm electrification
- (3) Mechanical equipment
- (4) Labor saving equipment
- (5) Fire and accident prevention
- (6) Surplus property

Farm Safety and Fire Prevention: The Extension Service has emphasized farm safety and fire prevention for the protection of lives, property, and agricultural supplies in conformity with a memorandum from the Secretary of Agriculture dated February 11, 1942. This program is conducted in (1) safety applied in all subject-matter, (2) fire prevention as an emergency requirement during the war and post war, (3) accident prevention in the home and on farms to conserve production capacity, supporting the Farm Labor Supply Program, (4) 4-H Club safety Award Contests, and training in health to over 500,000 boys and girls, and safety and fire prevention to approximately 389,177 boys and girls annually. Renewed emphasis has been given to safety for farm boys and girls in an annual safety award contest in 4-H Club work, in which the use of check sheets drawing attention to accident and fire hazards has brought about action by many more than the contestants. The 1946 extension statistical record indicates that 900,000 4-H Club boys and girls received definite training specifically in fire and accident prevention.

Cotton Ginning: The problems of the cotton farmer are the problems of the South and they vitally affect our national agricultural economy. Extension has for many years recognized its responsibilities to the cotton farmer by direct and continuous assistance in better production, harvesting, processing and marketing. A portion of this effort by extension workers has been directed toward cotton grade improvement through better harvesting, handling, and ginning methods. Drawing upon information developed through almost twenty years of continuous research at the U. S. Cotton Ginning Laboratory, Stoneville, Mississippi, and utilizing the wide field experience of producers, county agents, and cotton ginning specialists, extension has, during the past season, created the keenest interest in high grade cottons in the industry's history. This has resulted in unprecedented requests for advice and assistance from farmers, ginners, ginners' associations, farmer groups and others who are anxious to



retain grade value and increase returns to the producer.

The Federal specialists made a total of 500 gin visits during the 1946 fiscal year, and it is estimated that the seven State specialists visited some 1500 additional gins. On this basis, approximately 20 percent of the active gins that were in operation during the 1945-46 ginning season were visited, but during most of the season only two State specialists were employed as against seven at present. In connection with individual gin inspections and engineering assistance the specialists distributed 15,000 technical bulletins and other printed information giving assistance to the ginners.

In connection with gin visits made during the past fiscal year, a special effort has been made to assist ginners in their plant rearrangements to handle rough harvested or machine-picked cotton. Because of the interest in new harvesting devices this has become a major effort and is the most technical phase of the work that is being handled by the State and Federal cotton ginning specialists. Changes in the gin plant to enable the ginner to adequately handle cotton harvested by the new mechanical devices often occasion expenditures of from \$15,000 to \$50,000 per gin plant. Assistance of this nature requires a great deal of personal attention and a greater service for a few individuals, but it results in immediate gains of \$5 to \$10 per bale on cottons harvested with the spindle type picker. This \$5 and \$10 per bale increase in value of the cotton goes to the farmer producer; therefore, the additional effort and time is justified.

Some of the assistance given producers and ginners by the Extension Service in meeting harvesting and ginning problems include:

- (1) Individual assistance to producers and ginners by county agents and specialists in all cotton producing States.
- (2) Group meetings of producers and ginners to acquaint them with new production and harvesting methods such as chemical defoliation, flame cultivation, mechanical picking and stripping, and their effects on ginning procedure and ultimate value. These held in all cotton-producing States.
- (3) Group meetings of cotton gin operators to acquaint them with the gin operative problems involved in producing quality cotton.
- (4) Special visits by specialists to give specific harvesting and ginning assistance to producer and ginner in all cotton States.
- (5) Engineering assistance to the ginner in plant rearrangement to enable him to satisfactorily handle mechanically harvested cotton. These changes usually occasion expenditures of from \$15,000 to \$50,000 and reflect benefits to producer of \$5, to \$10 per bale. Every major cotton producing State given this assistance.
- (6) Utilized various publicity media and worked closely with all organized producer and ginner groups to carry out the better

grade program.

- (7) In cooperation with the U. S. D. A. Cotton Ginning Laboratory conducted a week's training course for State cotton ginning specialists. Ten States took part in this meeting.
- (8) Inaugurated a cotton insulation program in Texas. This has been in operation for several months.
- (9) Conducted a three-day cotton ginning school for the field personnel of the Dallas Area office of the Cotton Branch, Production and Marketing Administration.
- (10) Inspected 20 percent of the active cotton gins in operation in 1945. Such inspection was a basis for recommendations for machinery changes to bring about better quality cotton through better ginning.
- (11) Took part in 7-Step Cotton Improvement Program conferences in Dallas, Memphis, and Atlanta in November 1945.

Table below shows visits made to States and meetings attended in the interest of the various activities.

Projects	: Number : Federal : Specialists	: Number : State : Specialists	: Number : State : Visits	: Number : States : Visited	: Number : Meetings : Attended
Agricultural Engineering	1	138	15	12	14
Labor Saving	1	...	48	33	7
Agronomy	1	136	17	15	8
Cotton Production	1	11	13	7	7
Animal Husbandry)	1	117	17	12	3
Animal Diseases )		26			
Poultry	1	94	23	16	15
Meat	1	See Animal Husbandry and Food Preservation	18	15	23
Dairy	4	101	76	57	15
Entomology	1	41	21	17	6
Plant Pathology)	1	44	19	13	8
Horticulture )		147			
Forestry	2	67	44	35	3
Soil Conservation	4	48	66	40	33



(continued)

Projects	: Number	: Number	: Number	: Number	: Number
	: Federal	: State	: State	: States	: Meetings
	: Specialists	: Specialists	: Visits	: Visited	: Attended
Cotton Ginning	2	6	88	16	57
Section Programs	1	...	18	12	10
				Total	194

- (b) Development of Technical Subject Matter in Agricultural Economics and Rural Sociology may be divided into four groups, farm management and general economics, marketing, and rural sociology. The professional staff consists of four members assigned regional responsibilities on farm management and general economics; six members with national responsibilities in marketing on a commodity basis; and four working nationally on rural sociology problems.

The staff assists States in developing and further improving their extension programs in economics and related fields, assists State economists and rural sociologists in developing appropriate plans of work and annual reports and reviewing these as they are submitted to the Federal Extension Office; develops educational programs on special problems in connection with the postwar period of a social and economic nature; reviews economic research work developed by research agencies and assists in incorporating their findings into State economic extension programs; works with other Federal agencies in developing programs of an economic nature such as outlook, postwar planning, price control and support programs, and production goals; informs State extension workers of action taken by Federal agencies which will affect farmers and also reflects farm reaction to Federal programs of the Federal action agencies; develops regional or national economic analyses pertinent to special problems.

Some examples of programs conducted and methods used are as follows:

Outlook, Production Adjustments and Economic Information: Extension economists organized and conducted the national Outlook Conference which was attended by 125 workers representing 47 States. Particular attention was given to the long-term demand for various agricultural products and the postwar adjustments in farm organization and management. In order that county extension workers and farm people might be kept informed of current economic developments, Federal Extension workers sent materials and special reports to State workers throughout the year. Included were changes in price policy, subsidies, world food production, income tax regulations, farm land values, food orders, and production goals.

Farm and Home Financial Planning: Farm management specialists and the home management specialist cooperated in preparing a manuscript for an Extension circular on farm and home financial planning. They also cooperated with specialists in the States in developing educa-

tional programs to help guide farm families in making the most effective use of funds available to the family.

Farm Credit Education Work: Long-time objectives have motivated most extension work related to farm credit in 1945-46. Emphasis has been given to credit problems of young farm families, including veterans, and the hazards attending credit financing in this period of high production costs and soaring land values. Assistance has been rendered groups of bankers, and FCA institutions in planning credit services suited to farmers' needs. Farmers' cooperatives have been advised on financing problems.

Farm Tenure: Farm tenure problems continue to be of importance to farm leaders and others interested in the welfare of farm people. One of the extension economists served on a Department of Agriculture committee in the preparation of a comprehensive statement on farm tenure improvement in the United States. Extension economists also have given much attention to father and son agreements as a means of working out equitable and mutually satisfactory working relations for older farm owners and members of their families.

Cooperative Marketing: Many services have been rendered to farm cooperatives by extension marketing specialists. Practically every State and territory has an active program on one or more phases of cooperative marketing. The specialists in the Federal Office of Extension have assisted the States in surveying the possibilities of forming a successful cooperative, reorganizing existing cooperatives to meet tax requirements, modern operating methods, membership relations, additional services for farmers, and business management service for cooperative associations. Educational work in cooperative marketing has been implemented by the close working relationship with the Farm Credit Administration.

Strengthening and Developing Marketing Services: The Federal specialist in grain marketing cooperated with the States in holding 30 grain grading schools to develop a better understanding of grain grades and to show how grain should be handled to improve quality. The States in turn have conducted classes in grain grading at colleges and in vocational agricultural schools. Assistance was also rendered in developing an understanding of the operation of the market news service on a cooperative basis between the Federal and State Departments of Agriculture.

Coordinated Regional Marketing: Wartime expansion of production emphasized the need of attention to marketing problems and the coordination of the two programs. More of the State extension services are coordinating the programs of their production specialists in line with probable market demands and outlets for the products. This type of work may be illustrated by the joint program of the experiment stations and extension services in Minnesota and North Dakota to secure a solution to the production and marketing problems facing potato growers in the Red River Valley. The marketing specialist and the horticultural specialist on the Federal staff worked jointly with the State staffs to initiate a coordinated extension and research program. Other examples are (1) the New England Extension Dairy program which coordinates the results of dairy research work done in the 6 New England States into extension teaching material; (2) the



Southern Regional Poultry and Egg Conferences which provide opportunities for State specialists to review the existing marketing system in order to find more efficient methods of marketing poultry and eggs.

Major Accomplishments in Rural Sociology: Emphasis was given to helping State Extension workers train and use local leaders, interpret social data, analyze rural psychology and group relationships, and adapt State and Federal programs and extension methods to fit the needs and characteristics of rural people.

New Emphasis On, or Shifts In, the Programs of Work include:

Veterans' Advisory Assistance and Land Appraisals: The efforts of the Federal extension economists have included the selection and distribution to the States of suitable materials originating either nationally or in the States, advising and assisting State workers in the preparation of materials, and in bringing to their attention plans being used to provide needed services. The State economists have prepared materials and assisted in training county committees for their responsibilities.

Individual Farm and Home Planning: With the close of World War II, increased emphasis was given to long-time and short-time aspects of farm and home planning by individual farm operators and their families. The farm and home management specialists felt it was time to give more emphasis in their educational programs to: (1) economy of production, including efficiency in the use of labor, land, materials, and farm power; (2) balance of production to meet the needs of the market and the farm home; and (3) conservation of the factors of production, including land, labor, and materials. Federal specialists have developed materials illustrating how the farm and home planning project might be conducted on a Statewide basis along with suggestions on the nature and content of the planning forms. Economics specialists also worked with a national commercial organization in developing script for a movie on farm and home planning for use with farm groups.

The South-wide Cotton Educational Program: During the past year, the Federal Extension Service in cooperation with the State extension services inaugurated a Cotton Belt educational program designed to give cotton farmers all of the available facts and information to aid them in fully understanding the problems and issues with which they were confronted, and to furnish a basis for determining what should be done on the individual farm, and deciding as a group the policies and programs to be followed in the best interest of cotton producers and the nation at large. This represents a major new undertaking in developing and carrying out a coordinated educational program with a large group of farmers on a regional basis. The outstanding features of the cotton educational program during the past year were the preparation of informational materials and the initiation of work in the cotton producing States. An analysis was made of the economic problems facing cotton farmers. Two publications, "Looking Ahead With Cotton" and "Facts About Cotton," were prepared and distributed throughout the Cotton Belt. The Seven Step Program was developed, dealing with what individual farmers can do on their own farms to solve their cotton and farm income problems. Numerous other leaflets and suggestions were prepared and made available to the State extension services

and the press, dealing with methods and techniques of conducting the program and presenting it to the cotton farmers of the South. The program was launched through a series of regional conferences of State extension people, farm organization representatives and members of the cotton trade at Memphis, Tennessee, Dallas, Texas, and Atlanta, Georgia.

Discussion of Economic and Social Problems: Farm people are concerned about national economic policies directly affecting agriculture and about such general problems as inflation, taxation, employment, industrial wages, international relations, and world trade. Federal extension workers have discussed such topics at State meetings and have assisted State specialists to prepare materials for farm people on some of these problems. Greater emphasis will be given to this work during the next several years through the preparation of suitable teaching materials and by assisting State workers to develop programs and techniques for discussing economic and social problems.

Other Commodity Economic Educational Programs: In order to meet war needs and increased demands, there was a tremendous expansion in the production of many agricultural commodities. As the national agricultural economy and consumer purchasing power reverts to a more normal pattern, producers of peanuts, rice, tobacco, potatoes, and poultry products will be confronted with readjustments in production and market outlets. The Extension Service recognizes these conditions and plans to begin development of coordinated educational production and marketing programs for these commodities along the same lines as is being done for cotton.

Tabulation of Current Work Load  
July 1, 1945, to June 30, 1946

Number of em- ployees	Months Employed	State Contacts		Regional Conferences		Number of Committee Assign- ments	Number State Ext. Economists Assisted
		Number	Days	Number	Days		
		State	Spent	Attended	Spent		
		Contacts					
15	135	229	804	53	149	55	254

- (c) Development of Technical Subject Matter in Home Economics: The work under this project embraces the following fields of activity: (1) Home management which includes remodeling and construction of home buildings, family financial planning, work simplification in the home, economic outlook and trends, consumer education in marketing and selection of household equipment, and repair of home equipment; (2) food and nutrition which includes the planning of the family food supply, home food production, improved methods of home food preservation, improved methods of meal planning and food preparation, and health programs -- sanitation, safety, physical fitness, rural health centers and clinics; (3) clothing and textiles which includes the care and repair of clothing and household textiles, clothing



construction, planning and selection of clothing and household textiles, and the care of equipment; (4) parent education and family life which includes the scientific facts of human growth, maturation, aging, as well as human relationship and mental health factors of daily human experiences; (5) home industries which includes the construction and repair of home furnishings and the production of handicrafts for the makers own use and sale when skills have been sufficiently developed.

The home management, food preservation and nutrition, clothing and textiles specialists are all liaison staff members of the Extension Service and the Bureau of Human Nutrition and Home Economics. This arrangement facilitates a system of cooperation between Extension and the Bureau in attaining improved research in the spheres of mutual interest and provides farm families with a service which brings maximum satisfaction in rural living. It promotes the dissemination of current information, the publication of subject matter literature, and coordinates work with the State Agricultural Colleges in bringing information before the public and into the practices of farm families.

Home Management: During 1946 home management work stressed three main phases, namely, family economics, housing improvement, and work simplification in the home. The Annual Agricultural and Farm Family Living Outlook Conference gave special attention to family economics. In cooperation with the Economics Staff, the home management specialist prepared a circular on Farm and Home Financial Planning and another on Suggestions on How to Use the Farm and Home Financial Planning Circular. Consumer education programs were continued, emphasizing housing and household equipment. The construction and remodeling of houses and all around better housing conditions were phases of work stressed. In cooperation with the agricultural engineers and the Bureau of Human Nutrition and Home Economics, work on a "housing kit" was started. Work simplification in the home was carried on more extensively than ever. States who had not carried such a program before asked for assistance, and the results were wide-spread. Statistical reports show that:

24,768 families in 1,567 counties were assisted in the construction of dwellings during the year 1945.  
68,956 families in 1,995 counties received help in the remodeling of dwellings.  
159,127 families rearranged or improved their kitchens.  
182,344 families improved the arrangement of other rooms.  
174,934 families were assisted in the selection of house furnishings or equipment (other than electric).  
411,425 families reported improved housekeeping methods.  
291,109 families were assisted with time management problems.  
92,466 families were assisted with home accounts.  
124,358 families received aid with financial planning.

Foods and Nutrition: Attention has been directed toward achieving good nutrition under war and postwar conditions, as well as the long-time goal of the nutrition program. To attain this end, conservation of various types of syrups, and the use of other sweets have been encouraged in order to meet the limited sugar supply; work simplification methods have been applied to meal planning, preparation, and serving to counteract shortage of labor. National,

State, county, and local nutrition committees have taken an active part in the following community nutrition activities: school lunches, community meals, flour and corn meal enrichment legislation, and nutrition clinics. Canned food spoilage clinics have been held, and safe processes in canning have been stressed to reduce waste of food spoilage and to safeguard health.

The statistical summary for 1945 shows that:

- 1,554,354 families were assisted in improving diets.
- 1,291,588 families received assistance with food preparation.
- 2,387,434 families were aided with food preservation problems.
- 169,290 families received help with child-feeding problems.
- 16,824 schools were assisted in the establishment or maintenance of hot school lunches.
- 4,515 nutrition or health clinics were organized through the efforts of Extension workers.

A survey of the adult food preservation program shows:

- 580,224,596 quarts canned.
- 7,883,935 gallons brined.
- 22,824,026 pounds dried.
- 204,358,341 pounds cured.
- 448,827,368 pounds stored.
- 195,423,709 pounds frozen.

4-H Club food projects show:

- 33,540,626 quarts canned.
- 250,583 gallons brined.
- 653,096 pounds dried.
- 2,379,910 pounds cured.
- 8,540,112 pounds stored.
- 1,532,592 pounds frozen.

Clothing and Textiles: The major phases of work undertaken in clothing include care and repair of clothing and household textiles, clothing construction, selection of clothing and household textiles, and the care of equipment. Because of the scarcity of essential low and medium priced garments, and poor quality of ready-made clothing available, a great deal of work was done on remodeling, care of clothing and home sewing of new garments. Untrained women learned new and efficient methods of clothing construction, while homemakers with previous sewing experience tried their skill in the more difficult fields of tailoring coats, suits and other garments for outdoor wear for the family. Clinics and workshops for remodeling garments, and sewing machine clinics were held throughout the country. New mending techniques, new controls for household pests and planning clothing storage space for modern or remodeled homes have given zest to old projects on care and repair of clothing. Special attention has been directed to wise buying, stressing the importance of careful analysis before purchases are made.

Parent Education: The parent education and family life program has stressed home and family adjustments to the returned service man; material and infant care; adjustment of adolescent; family and



neighborhood recreation; the school child's development; the 4-H Club child care project; and discussions of marriage in young adult groups. With increasing numbers of State and county extension workers requesting assistance in solving the problems of farm families who were disrupted during the war years, the parent and family life education programs in the States has served 20 percent more men and women, more youth and whole families than in previous years. The major enterprise for the year has been to train extension workers in the problem solving and family counselling methods, and the group action discussion pattern.

Home Industries: The Home Industries program is designed to fulfill the needs in rural life by helping farm people provide comforts and conveniences through the skills of their hands. The work has been adapted to meet the requirements and desires of rural families according to their cultural background, talents, physical and mental abilities, social standards of living, and the economic condition under which they live. The work has been carried forward through a broad educational program which not only embraces Extension Service but organizations, groups, and individuals interested in handicrafts throughout the country. The major enterprise has been training leaders to give handicraft demonstrations and assist individual craftsmen with problems. The following types of handicraft work have been stressed, reclaiming furniture (repairing, reupholstering and remodeling), metal work, leather glove making, willow basketry, equipment for home recreation (games, toys, and other play equipment), handweaving for clothing and household linens, preparation of native materials for use in handicrafts.

The Home Economics subject matter is being directed toward meeting postwar conditions, including special emphasis on family economics, housing, and work simplification; good nutrition and conservation of limited food products for famine relief; the utilization of clothing and household fabrics on hand, and training of increasing numbers of homemakers in clothing construction, selection and careful analysis of buying in order to distribute equitably the scarce supply of civilian clothing; aid in the adjustment of family life to the serious problems resultant to the war and aftermath; aid to the representatives of the war-torn countries, and veterans in the establishment of handicraft projects or training programs.

Six Federal specialists operating under project agreement with the Bureau of Human Nutrition and Home Economics conducted cooperative extension work with 273 State extension specialists in home economics subject matter to make the scientific and technological findings in the field of human nutrition and home economics available to farm people through State and county cooperative extension work. The specialists conduct programs in various States and assist in National regional and Interstate development of programs in home economics. During the year, the six Federal specialists made 121 visits to 48 States.

4-H Club Work: 4-H Club work is an important phase of all home economics work. Each specialist prepared suggestions and recommendations for 4-H Club work in their respective fields. They have taken active part in 4-H Club Committee work and participated in National and State 4-H Club activities.

Field Studies of Extension Work and the Training of Extension Workers:

This staff conducts field studies to determine the effectiveness of extension administration, organization, programs, and methods of teaching to provide an objective basis for the improvement of extension, and makes recommendations for adjustments; maintains a readability laboratory to improve extension publications; collects and analyzes factual data on national accomplishments of the cooperative extension service; organizes and promotes comprehensive personnel training programs for county, State, and Federal extension workers; assists in the training of students from foreign countries in the principles and practices of extension education, and cooperates with State extension services in establishing and maintaining area field study and training centers.

Major accomplishments during the past year include:

Field Studies: In home demonstration work a study to determine training needed by home demonstration agents was summarized and a manuscript prepared for use of State Home Demonstration Leaders and Deans of Home Economics; the home demonstration agent's job was analyzed and the data obtained used to assist agents in effective time management and program development; Massachusetts was assisted in a study on the effectiveness of their home demonstration organization; and a field study of techniques used in extension home demonstration supervision was completed. In 4-H Club work assistance was given in conducting a nation-wide study of what 15-21 year olds want in 4-H Club programs; a study was made of the problem of adapting 4-H Club activities to the needs of boys and girls of high school age; the State of Kentucky was assisted in making an appraisal of their 4-H Club work; and a study was completed of the needs and interests of older 4-H Club boys and girls in Washington and Oregon. Other studies included a survey of the effectiveness of radio in extension work in Ward County, North Dakota, where local extension agents have been conducting a farm program for over five years. The radio is reaching a large number of farm families who have never participated in extension. An analysis was made of the relative effectiveness of teaching via radio, leaflet and other extension teaching methods in Wisconsin. The effectiveness of the Extension Service Review, the Louisiana Farmers Almanac, and the Connecticut Homemaker was studied to determine whether or not these publications are being read and used by the audience they are written for. Several of the States were assisted in various studies -- New Hampshire in a study essentially for the education of staff members and the resulting information was given to the New Hampshire Extension Service -- Nebraska in planning an over-all study of the Nebraska Extension Service, -- and Mississippi in a study of the effectiveness of extension education in a Mississippi county.

Studies and Analysis of Readability of Publications: Over three thousand samples of agricultural and home economics publications from nearly every State were analyzed to determine if the average farm adult can be expected to understand them. Fifty-five percent of the samples are rated above the reading level of the average farm adult in the United States.

Annual Report Summary: Statistical reports from all States were tabulated and summarized. Special information, as requested by various extension staff members was assembled. About 4500 narrative reports from extension workers were read and indexed. Briefs on 74 topics were abstracted from these reports. This is one method of spreading information from State to State.



Training Extension Workers: Particular emphasis was placed on developing programs to handle specific training in teaching procedures to meet the needs of extension work today. Some of these needs center around the training of new workers, (approximately 1500 new workers were added during 1945-46), agents returning from the armed forces, and those who are on the job. Summer schools for the express purpose of training extension workers were held in eight States this year. This staff contributed materially in preparation of teaching materials, outlines for courses, and the provision of teaching staffs. State leaders appointed to set up field studies and training programs are receiving training and assistance in developing their plans. Twelve workshops - a work conference method of training - were planned or carried out. These workshops trained extension personnel in supervision, evaluation and publications, and housing.

Preparation and Distribution of visual material and Extension Literature to Department and State Extension Forces:

The major activities undertaken under this project are to supply the 10,500 cooperative extension workers with educational and informational materials and give them proven techniques for preparing and using visual aids, publications, radio and other mass educational media in their local educational work. Other activities include (a) supplying supporting educational material to the national and regional magazines, radio stations, newspapers and other outlets as a backdrop for the cooperative extension local educational effort, (b) coordinating the information work of Department agencies with that of the cooperating State extension services, and (c) informing the public nationally of cooperative extension activities and results. In more detail, these activities fall into several categories.

Keeping Cooperative extension workers informed: Weekly news letters are prepared dealing with policy and program announcements of the Secretary of Agriculture and other Government officials and sent on a spot-news basis administratively to the 48 cooperative State extension directors and informationally to State extension editors.

Assisting the cooperative State Extension Services in developing stronger, coordinated information programs: This is done through reviewing and approving each State information plan of work, following up on weak spots in the plans, visiting the State offices, planning sets of special information campaign materials the States can localize and use, passing good examples of work in one State to other states, and working closely with an advisory committee of leading extension editors each year to agree on cooperative policies and procedures. One of the most effective ways used to spread good local experiences of extension work so that other workers can profit by them is the Extension Service Review. Eleven issues were printed during the year and sent to the 10,000 cooperative extension workers.

Training workers in mass education techniques: This is accomplished largely through assisting the State extension editors, radio and visual specialists, to hold State and district training schools for county and State extension workers. Two extension radio specialists are employed cooperatively with the Department Radio Service, and during the year they assisted the State offices in holding 50 radio training schools attended by 750 extension and other Department workers. The two day schools featured special training and practice in educational use of radio. Two publication improvement workshops were held during the year, and attended by representatives from more than half the State extension offices. A

radio handbook, a slide film on how to write effective educational circular letters and other training materials were prepared during the year and sent to extension workers.

An important phase of the work under this project is carried on by supplying factual educational material to the National and Regional magazines, newspapers, radio networks and advertising agencies. Usually this material acquaints the public with the national needs, such as need for gardens, food preservation or farm workers, and refers them to the local county agent for further help or asks them to be ready for the local call in their community. Likewise 40 extension radio programs over the networks and major individual stations were scheduled during the year, and the Extension Service cooperated in distributing to radio stations over the country through State extension editors about 800 transcriptions and a regular supply of radio script prepared in the Department.

In a cooperative educational program on cotton and the South's economy, this staff was largely responsible for preparing or arranging for three publications, two motion pictures, 1,000 sets of a small exhibit, 150 copies each of five radio transcriptions, several timely fact sheets, a special press-radio advertising brochure and a complete kit of educational material, themes and suggestions for use of local cooperative extension workers. Prior to this, much was done to base the program on a sound public relations basis and to write the points of the program in simple appealing things farm people needed to do. Other special educational programs or campaigns carried on during the year included, food production and the famine emergency program, price control and rationing, fat salvage, rural housing, farm safety, 4-H Club work, home demonstration work, and assistance in emergency recruitment and efficient use of farm labor.

Distribution and General Services: Orders from cooperative state extension workers for nearly 6½ million copies of Department printed publications and a half million copies of other materials had to be handled, seventeen new Department publications were prepared and edited involving 1½ million copies, keeping State extension workers informed of Department programs and policy announcements. About 1,200 pages or smaller units of art work to help visualize educational material were prepared; over 2,000 new photographs were taken in field trips in 14 States, and 10,000 prints of photographs were made and distributed to 32 magazines and for use in State extension educational material; eight new slide films were made during the year and nearly 8,000 slide films were requested for educational use.

(c) Bankhead-Jones Act, Section 23, Title II  
(Act of June 29, 1935), as amended by the Act  
of June 6, 1945, Public Law 76.)

This budget schedule covers expenses under an allotment for Federal Extension Service administration under the Bankhead-Jones Act, Section 23, Title II, which was previously discussed in these Explanatory Notes under the appropriation item "Payments to States, Hawaii, Alaska, and Puerto Rico."

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Farm and Other Private Forestry Cooperation, Department of Agriculture (Extension Service): Cooperation with States for extension activities in developing farm forestry under the --			
Norris-Doxey Act .....	\$ 31,226	\$ 40,577	\$ 40,577
Clarke-McNary Act, Section 5 .....	60,972	65,766	65,766
Total, Farm and Other Private Forestry Cooperation .....	92,198	106,343	106,343
Administrative Expenses, Section 392, Agri- cultural Adjustment Act of 1938 (Extension Service): Special assistance to the Pro- duction and Marketing Administration in connection with agricultural conservation program in Alaska .....	--	675	675
Exportation and Domestic Consumption of Agricultural Commodities (Extension Service):			
Special assistance on agricultural marketing agreement programs in connection with the requirements of the Production and Marketing Administration .....	7,828	8,790	--
Salaries and expenses, War Food Administra- tion (Extension Service): Emergency ex- tension work necessary to the prosecution of War Food Administration programs .....	104,446	--	--
Working Funds, Agriculture, Extension Service, Advances from:			
Department of the Interior: Bureau of Rec- lamation, for special assistance on reclamation projects .....	4,737	--	--
Treasury Department: Procurement Divi- sion, to conduct extension training program for Chinese agricultural technicians .....	11,293	5,052	--
The Institute of Inter-American Affairs:			
Food Supply Division, for assistance in placing and training Latin-American trainees in extension work and farm practices .....	4,733	--	--
Total, Working Funds .....	20,763	5,052	--

(continued on next page)



Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Supply and distribution of farm labor:			
Mobilization of local labor under the Department's farm labor program a/ .....	7,705,585	7,357,125	- -
Penalty Mail Costs, Department of Agriculture (Allotment to Extension Service): For cost of penalty mail pursuant to Section 2, Public Law 364, 78th Congress .....	714,261	880,000	1,050,000
Cooperation with American Republics (Transfer from State Department):			
Training in agricultural and home economics extension work of trainees from other American Republics b/ .....	25,000	35,108	40,355
TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL FUNDS .	8,670,081	8,393,093	1,197,373

a/ Allotment from funds appropriated on a calendar year basis for the farm labor supply program in a separate act. Availability of present funds appropriated for this program is limited to June 30, 1947.

b/ Schedule for this item appears in the State Department chapter of the Budget.



## AGRICULTURAL RESEARCH ADMINISTRATION

### OFFICE OF ADMINISTRATOR

The Office of Administrator, Agricultural Research Administration provides for over-all direction and supervision of the Administration which comprises the Bureaus of Animal Industry; Dairy Industry; Plant Industry, Soils, and Agricultural Engineering; Entomology and Plant Quarantine; Agricultural and Industrial Chemistry; Human Nutrition and Home Economics; and the Office of Experiment Stations. The Administrator also is responsible for general administration of the Special Research Fund, including supervision of the U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, New York, and general supervision of the Agricultural Research Center.

The Office of Administrator plans, develops, coordinates, and directs the scientific research program of the Agricultural Research Administration to assure the most effective utilization of personnel and facilities; relates this research program with those going forward in private industry and in other Governmental agencies; and determines research objectives in the light of changing needs of agriculture and the Nation's requirements for food, feed, and fiber.

Administration and Over-all Direction of the Agricultural Research Administration: The Office of Administrator is the clearing agency for a wide variety of subjects involving many phases of technical, as well as budgetary, fiscal, and other administrative activities of the constituent research bureaus of the Department of Agriculture.

The members of the staff consider and make recommendations concerning each proposed individual research project, each project estimate, and each proposed memorandum of understanding covering cooperative research between bureaus within the Administration and with outside agencies of the Federal Government, the various States, and private organizations.

The methods of integrating and coordinating the various research projects of the Administration have been outlined in connection with the estimates for previous years.

An example of the integrated approach to agricultural investigations for which the Administrator's office is primarily responsible is that of the legume seed program presented in the Budget Estimates last year and approved by Congress, and being placed in effect in the fiscal year 1947. Legumes provide crops of value not only for feed and for their cash value but also to prevent soil depletion. Very heavy decreases in seed yield of clover and alfalfa in recent years have, therefore, been a matter of great concern and potential loss to American agriculture. The problem of increasing yields involves the fields of work of several different divisions in at least two bureaus of the Administration. Through the Agricultural Research Administration a joint program was developed under which the problems of (a) pollinating insects, (b) injurious insects,

(c) crop management problems, and (d) variety development, will be worked out as a coordinated whole. In several locations at which investigations are being undertaken representatives of all these fields of work are being stationed. They will be working under the joint direction of the several interested divisions and bureaus concerned. Through concerted action this type of coordinated program brings about greater effectiveness in each research field involved.

Within the last year or so, the Secretary of Agriculture has delegated to the Agricultural Research Administrator the responsibility, except where major department policy is involved, of final determination on cooperative agreements relating to department research.

The Research Administrator also acts for the Secretary in the matter of United States licenses issued under patent applications and Letters Patent controlled by the Department of Agriculture, and is authorized to deal with the Commissioner of Patents in connection with patent applications and certifications that the inventions involved are used or liable to be used in the public interest.

Among other types of problems coming before the Administrator's office is consideration of legislation affecting many kinds of agricultural activities. The office has participated extensively in handling the Department's reports on several bills relating to agricultural research, insect and plant disease control programs, and the protection of the public from losses due to either fraud or inadequate information on technical materials and equipment employed in agricultural operations.

In some of its activities the Administrator's staff is in continuous contact with the Office of Foreign Agricultural Relations as an advisor on the scientific aspects of programs having international significance, including advice as to matters of interest throughout the United States for large numbers of foreign visitors in this country.

During 1946 the Administrator's office also acted as the clearing house for many questions relating to scientific personnel which affected all the research bureaus of the Department. The change from war to peace made it necessary for the Civil Service Commission to set up provisions both for the permanent postwar peace time organization and the interim period between the ending of hostilities and the establishment of Civil Service registers. The staff of the Administrator's office took active part in advising the personnel office of the Department and also the Civil Service Commission with respect to the solution of problems involving the recruitment and retention of personnel engaged in scientific research.

Supervision of maintenance, operation, and furnishing of facilities and services at the Agricultural Research Center: These facilities and services include operation of a sewage disposal plant and system; fire protection (last year ten fires on the Center area were attended by Center employees organized as a fire control force); construction and maintenance of roads; handling numerous American and foreign visitors at the Center; provision for infirmary and emergency first aid service; operation of mail and messenger service; furnishing guard service and a 24-hour per day central telephone service; centralized purchasing of fuel, feed, and other supplies; and maintenance of administrative services in connection therewith.

Direct services are furnished to ten bureaus of the Department and four other government agencies conducting work at the Center on a reimbursable basis. These services include heat, electricity, gas, and water, the maintenance and repair of structures and equipment, mechanical shop service, and general farm work and supplies, as requested by the bureaus. This reimbursable work amounted to approximately \$961,000 during the fiscal year 1946.

The sewage disposal plant treated approximately 132,000,000 gallons of sewage; 168,000,000 gallons of water were supplied through the water system; 7,103,000 K.W.H. of electricity were purchased and distributed; and the heating plants produced and supplied approximately 60,000,000 pounds of steam for heating and 12,600,000 pounds of processed steam for laboratories.

The granary purchased basic grains and concentrates and processed 3,216 tons of poultry and livestock feeds according to experimental feeding formulas. 18,000 tons of coal were purchased and delivered to heating plants. The mechanical shops received and completed more than 5,000 requests for service. The farm operations unit performed necessary farm and field work as required by the research bureaus.

Current activities contemplate, in addition to the regular program of maintenance and operation, the constructing and equipping of a water treatment plant; construction of  $3/4$  mile of new road; erection of 2.6 miles of boundary fence; and installation of fire escapes on the central group of laboratory buildings.



STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
<u>Special Research Fund,</u>			
<u>Department of Agriculture:</u>			
For laboratory for research			
into relation of soils to			
plant, animal, and human			
nutrition .....	107,651:	116,600:	116,600
<u>Working Funds (Office of</u>			
<u>Administrator, Agricultural</u>			
<u>Research Administration)</u>			
<u>Advances from:</u>			
<u>Public Buildings</u>			
<u>Administration: Emer-</u>			
gency guards at the			
central guard office,			
Agricultural Research			
Center .....	1,392:	- -:	- -
<u>War Department: Liming,</u>			
fertilizing, seeding and			
mulching required to			
restore approximately			
500 acres at the			
Agricultural Research			
Center used by War			
Department as an airport.	15,925:	75:	- -
Total, Working Funds ..	17,317:	75:	- -
<u>Penalty Mail Costs, Department</u>			
<u>of Agriculture (Allotment to</u>			
<u>Office of Administrator,</u>			
<u>Agricultural Research Admin-</u>			
<u>istration): For cost of</u>			
penalty mail pursuant to			
Section 2, Public Law 364,			
78th Congress .....	389:	400:	496
<u>TOTAL OBLIGATIONS UNDER</u>			
<u>SUPPLEMENTAL FUNDS .....</u>	125,357:	117,075:	117,096



## SPECIAL RESEARCH FUND, DEPARTMENT OF AGRICULTURE

General: Section 4, title I, of the Bankhead-Jones Act (approved June 29, 1935) provides that 40 percent of the fund appropriated in any one fiscal year pursuant to that Title shall constitute the "Special research fund, Department of Agriculture," and shall be available for (a) the establishment and maintenance of research laboratories and facilities in major agricultural regions of the United States and the prosecution of research at such laboratories; (b) special research projects approved by the Secretary of Agriculture and conducted by such agencies of the Department of Agriculture as the Secretary may designate or establish; and (c) administration of provisions of the Act authorizing payments to States, Hawaii, Alaska, and Puerto Rico for research to be conducted by agricultural experiment stations. Section 1 of the Act as reenacted by Sec. 10(d) of the Act of August 14, 1946, specifies that the work conducted under the Special Research Fund shall be "research into laws and principles underlying basic problems of agriculture in its broadest aspects; research relating to the improvement of the quality of, and the development of new and improved methods of production of, distribution of, and new and extended uses and markets for, agricultural commodities and byproducts and manufactures thereof; and research relating to the conservation, development, and use of land and water resources for agricultural purposes."

The amount authorized according to the terms of the Act, is distributed on the basis of 50 percent for regional laboratories, 48 percent for special research projects, and 2 percent for the administration of Bankhead-Jones payments to States. This percentage distribution was followed in the appropriation until the fiscal year 1942 when the appropriation for the Special Research Fund was reduced; however, none of the reduction was applied to the amount for regional laboratories. Since that time the amount for regional laboratories has been specifically stated in the appropriation act.

The actual and estimated appropriations and the authorized appropriations under title I of the Bankhead-Jones Act for the Special Research Fund since its establishment are as follows:

Fiscal year	Appropriated						Total authorized
	Administration:						
	Regional	Special	of Bankhead-				
	laboratories:	research:	Jones payments:	Total			
		projects:	to States				
1936	: \$ 200,000:	\$ 192,000:	\$ 8,000:	\$ 400,000:	\$	400,000	
1937	: 400,000:	384,000:	16,000:	800,000:	:	800,000	
1938	: 600,000:	576,000:	24,000:	1,200,000:	:	1,200,000	
1939	: 700,000:	672,000:	28,000:	1,400,000:	:	1,600,000	
1940	: 700,000:	672,000:	28,000:	1,400,000:	:	2,000,000	
1941	: 700,000:	672,000:	28,000:	1,400,000:	:	2,000,000	
1942	: 701,528:	460,003:	24,769:	1,206,300:	:	2,000,000	
1943	: 700,000:	427,000:	23,000:	1,150,000:	:	2,000,000	
1944	: 733,100:	456,045:	22,941: <sup>a/</sup>	1,212,086:	:	2,000,000	
1945	: 742,315:	461,108:	22,941: <sup>b/</sup>	1,226,364:	:	2,000,000	
1946	: 732,177:	451,832:	23,991: <sup>c/</sup>	1,208,000:	:	2,000,000	
*1947	: 785,200:	491,900:	25,900: <sup>d/</sup>	1,303,000:	:	2,000,000	
*1948	: 785,200:	491,900:	25,900:	1,303,000:	:	2,000,000	

\* Estimated

- a/ Includes \$65,000 appropriated in the First Supplemental Appropriation Act, 1944, for overtime.
- b/ Excludes \$23,473 transferred in 1945 Appropriation Act to "Salaries and expenses, Office of Administrator, Agricultural Research Administration."
- c/ Includes \$120,000 appropriated by the Act of April 19, 1946 (Public Law 349) pursuant to Federal Employees Pay Act of 1945 (Public Law 106).
- d/ Includes \$110,000 estimated additional funds required pursuant to Federal Employees Pay Act of 1946 (Public Law 390).

Special Research Laboratories in Major Agricultural Regions:

Nine regional laboratories have been established under the provisions of Sections 1 and 4 of the Bankhead-Jones Act of June 29, 1935, to provide a joint Department and State experiment station attack on problems of regional or national scope. These regional laboratories, which were established and are conducted in each case with the cooperation and participation of the State agricultural experiment stations in the respective regions, serve as focal centers for regional coordination and cooperation on research in the subjects under study by the laboratories. The work of the laboratories is centered especially upon phases of the problem under study which would be difficult or impossible for an individual State or a group of States to undertake.

The allotments made to Special Research Fund Regional Laboratories for the fiscal year 1946 and the estimated allotments for the fiscal years 1947 and 1948, are as follows:

Laboratory	Location	Estimated		
		Allotment	Allotment	Allotment
		1946	1947	1948
1. Regional Vegetable:				
Breeding Labora-				
tory .....	Charleston, S. C.	\$ 71,413	\$ 76,000	\$ 76,000
2. Regional Pasture				
Research Labora-				
tory .....	State College, Pa.	63,580	68,200	68,200
3. Regional Soybean				
Laboratory .....	Urbana, Ill.	89,960	96,900	96,900
4. Regional Swine				
Breeding Labora-				
tory .....	Ames, Iowa	64,737	66,700	66,700
5. Regional Sheep				
Breeding Labora-				
tory ..	Dubois, Idaho	61,190	66,000	66,000
6. Regional Animal Di-				
sease Laboratory	Auburn, Ala.	66,244	69,600	69,600
7. Regional Laboratory:				
for Improvement				
of Viability in				
Poultry .....	East Lansing, Mich.	111,163	120,600	120,600
8. Regional Salinity				
Laboratory .....	Riverside, Cal.	95,850	104,600	104,600

Laboratory	Location	:Estimated:Estimated		
		:Allotment:	:Allotment:	:Allotment
		: 1946	: 1947	: 1948
9. Regional Labora-				
tory for Research:				
into the Relation:				
of Soils to Plant:				
Animal and Human :				
Nutrition .....	Ithaca, N. Y.	108,040:	116,600:	116,600
Total available .....		732,177:	785,200:	785,200
Excess of obligations				
over appropriation				
due to Public Law 390 .....		- -:	-62,074:	- -
Total appropriation or				
estimate, Special				
Research Fund Regional				
Laboratories .....		732,177:	723,126:	785,200

Examples of Progress and Current Program: The following are examples of progress made and work conducted at each of the laboratories during the fiscal year 1946:

Regional Vegetable Breeding Laboratory: (Approved by the Secretary, November 30, 1935; located at Charleston, South Carolina).

General Objective: The primary purposes of this laboratory are the determination of principles and methods of breeding that may be adopted in developing vegetables that possess disease resistance, quality, and adaptation to specific conditions; and the finding and use of superior germ plasm in the production of new disease and insect resistant varieties and strains of vegetables of high quality and high yielding ability especially adapted to adverse climatic conditions in the Southeast. The principles and materials developed at the laboratory are used or tested in practical breeding experiments by the cooperating states and others. The current program includes work on peas, snap beans, watermelons, cabbage, sweet corn, and tomatoes. Preliminary studies are in progress on lima beans, carrots and asparagus, which will be expanded at a later date.

Several lines of tomatoes developed by the laboratory were discovered to be resistant to the tomato late blight disease while being increased for production in Florida during the spring of 1946. This disease, ordinarily of minor importance, damaged tomatoes to the extent of several millions of dollars in Florida, Georgia, and South Carolina, and some damage from the disease has been reported from several other states. Had these new lines, some of which now combine resistance to late blight, collar rot, early blight, and fusarium wilt, been available for commercial production a great portion of the losses could have been avoided.



The Southern Tomato Exchange Program has been organized to foster extensive cooperative trials of new tomatoes developed in and for the South so as to insure the widest possible range of tests for adaptation and utilization. Forty-one new tomatoes were included in this program in 1946.

Seed of the Wando pea variety developed by the laboratory are not now available because seedsmen, following an unprecedented demand for the seed, have planted all available seed to increase the supply, rather than selling the limited stocks on hand. The present indications are that wando may become a major pea variety for freezing and as a hardy home garden type.

Tests with 25 varieties of peas for 3 years indicate that there are statistically significant varietal differences in the thiamine, ascorbic acid, carotene, and riboflavin contents. These differences are great enough to be important from the human nutrition standpoint in the case of thiamine, ascorbic acid, and carotene.

The Logan snap bean, a product of the laboratory program, has been so satisfactory in extensive trials, that it will probably replace, in many areas, the now commonly grown but relatively non-hardy Tendergreen variety. Other lines of snap beans indicate that the breeding program is combining in them resistance to bacterial blight, mosaic, and powdery mildew. When these characters are fixed the South will be provided with some very hardy varieties.

Regional Pasture Research Laboratory: (Approved by the Secretary, February 20, 1936; located at State College, Pennsylvania).

General Objective: The pasture improvement program of the laboratory was initiated for the purpose of increasing the productiveness of pasture during the entire grazing season and to provide surpluses in the form of grass silage or hay to be used as roughage for cows during periods when pasture is not available. In cooperation with the 12 Northeastern States the program was initiated to overcome the most serious handicap of the milk producers of the region, namely inadequate nutritious forage throughout the grazing season. The cooperative effort is making notable progress by the development of improved techniques and principles of breeding, improved strains of pasture plants, and better pasture management practices.

Cooperative products between 11 State agricultural experiment stations and the laboratory numbered 21 during the year. Eight of these projects were concerned with breeding for improved strains of various pasture grasses and legumes, 6 with pasture renovation, 3 with pasture management involving the use of animals to measure results, 1 with the effect of climate on plant growth, 1 with the effect of temperature on growth of colonial bentgrass, 1 with the nutritive value of pasture plants, and 1 with over-liming injury.

A total of 210 new strains of Kentucky bluegrass, orchard grass, brome-grass, meadow fescue, timothy, white clover, Ladino clover and alfalfa has been developed. Of these, 144 varieties and strains are being



evaluated at the laboratory in replicated plot experiments involving more than 1200 plots. In the process of development of additional new varieties, more than 900 selected clones are in various stages of evaluation from testing as replicated plants to testing in plots of their seed progeny. This involves more than 800 plots and over 12,000 individual plants. In addition, about 23,000 individual plants are being grown and studied as source material for selection of additional clones to be used in development of new and better varieties.

Fifty-four clones of Ladino clover, selected and tested at the laboratory, have been included in a country-wide testing program designed to provide new foundation material for production of certified Ladino seed. This move was necessitated by extensive contamination, through mechanical mixtures and cross-pollination, of commercial Ladino clover with common white clover.

The laboratory program has shown that one of the most effective means of supplying feed during July and August, when permanent pastures are usually unproductive, is by the use of larger-growing and deeper-rooted grasses and legumes from which the first crop may be harvested for hay or grass silage and the aftermath grazed during the remainder of the season. In cooperative trials it was found that an association of orchard grass and Ladino clover produced abundant pasture during mid-summer but a small amount of silage in the first crop, while brome grass and Ladino clover produced a large silage crop but a more limited amount of grazing. These results indicate that a milk producer can determine his pasture mixture on the basis of the needs of his particular farm.

Attention has been given recently to creating artificial epidemics of important diseases of pasture plants in order that resistance, if present, can be detected. One of these diseases is Stagonospora leaf spot in orchard grass. Use of greenhouse inoculations to facilitate this program has been limited by failure of the organism to produce spores in the greenhouse. During the year it was found that the fungus would produce spores six weeks after inoculation on a wild form of orchard grass. The pathogenicity of these spores was verified by successful inoculation in the greenhouse of susceptible plants of commercial orchard grass.

Regional Soybean Laboratory: (Approved by the Secretary, February 20, 1936; located at Urbana, Illinois).

General Objective: The work of the laboratory is directed toward production, through breeding and selection, of improved varieties and strains of soybeans for industrial utilization. The annual soybean crop is estimated to be worth over \$500,000,000 to producers, and soybean processing is now a 400 million dollar-a-year industry. Improved varieties, adapted to a wide range of environmental conditions, are essential to continued favorable agricultural position of this crop which is relatively a newcomer in our American agriculture.

The addition of 100 million pounds of edible oil to our supply of fats and oils in 1946 is promised through the widespread use of 2 new soybean varieties, Lincoln and Ogden, evaluated by the cooperative uniform

testing program developed by the laboratory. These varieties yield substantially more than the strains they are replacing and have a higher oil content. Due to the higher yield, these varieties also will add over 100,000 tons of high protein meal to our supply of feedstuffs.

Two improved varieties now being increased for release will replace old standard varieties in particular areas. One of these varieties, a selection from a cross between Richland and Mukden, will be adapted to the northern part of the main soybean producing belt, north of the main Lincoln area. The beans from this selection have superior commercial qualities. The other variety, Roanoke, is a high yielding, high oil variety, later in maturity than Ogden, and will be useful in parts of the Southern States where Ogden is not well adapted.

During the past year a reliable method for testing strains in the field for their reaction to the bacterial leaf spot diseases has been developed. The desired inoculum is applied with a power sprayer near mid-day. Time of application and the force with which the inoculum is applied were found to be the controlling factors in the successful production of infection in test material. By use of this method it was established that the variety C. N. S. is highly resistant to the bacterial pustule disease. Breeding work has been undertaken to utilize this resistance.

Brown stem rot of soybeans, a new and very destructive fungus disease, has been shown to be dependent upon low air temperatures for development. It was proved conclusively that downy mildew of soybean is seed transmitted. The details of the infection of the young seedling with this disease are now known and work can proceed on methods of control such as by seed treatment and breeding for resistance.

Simulated hail damage studies initiated in 1943 have been continued and serve as a basis for estimating the effect of hail damage on yield and composition of soybean seed. For a given severity of treatment, reduction in yield is small if the damage occurs during the early stages of growth, becoming increasingly greater until the early pod stage, after which yield again is less severely affected. Damage at early stages of growth delays maturity and at late stages hastens maturity. The oil content of the seed is decreased in soybean plants severely damaged by hail, during pod formation, whereas the iodine number of the oil is increased.

Regional Swine Breeding Laboratory: (Approved by the Secretary, December 22, 1936; located at Ames, Iowa).

General Objective: The laboratory is attempting, through research, to explore the possibilities for applying the science of breeding, including recently discovered techniques, to speed the improvement of swine. The laboratory program was planned to discover, develop, and test procedures of breeding that may be used by hog producers in improving productiveness of sows, growth rate of pigs, economy of gain, vitality of pigs, and desirability of carcasses.



In carrying out its major objective the laboratory is studying the usefulness of inbred lines for improving the breeding value of pure breeds for pork production; is enlarging the knowledge concerning the genetic effects of inbreeding and the inheritance of characters in swine; and is demonstrating and evaluating the application of such knowledge in swine breeding. In each phase of the program emphasis is given to such characters as productiveness of sows, vitality of pigs, growth rate, economy of gain, and desirability of carcasses.

The different phases of the program are being pursued through projects in progress at the following cooperating stations in the North Central region: Illinois, Indiana, Iowa, Minnesota, Missouri, Nebraska, Oklahoma, and Wisconsin. Three other stations in the region (Michigan, Ohio, and South Dakota) have projects which are closely coordinated informally with the major program. Two stations outside the region (Arkansas and North Carolina) have initiated projects that are informally coordinated with the program of the laboratory. Breeds included in herds at the various cooperating stations are: Poland China, Duroc Jersey, Hampshire, Danish Landrace, Chester White, Danish Landrace x Tamworth, Yorkshire x Poland China, and (Landrace - Tamworth) x Duroc Jersey. Approximately 800 litters were produced in 1945.

A total of 351 boars and 548 sows were released to farmers during the year from 5 of the cooperating stations. While it has not been possible to obtain accurate reports on the performance of much of the stock sold to farmers, such reports as are received are for the most part quite favorable. Many farmers have repeatedly returned to the stations for breeding stock. The complaints received were largely in regard to inbred boars failing to breed or requiring much skill and patience in getting service from them.

Breeders who have obtained over a period of several years, breeding stock from the cooperative project at the Minnesota Experiment Station are so enthusiastic as to the usefulness of these animals that they are meeting to form an organization to register the animals. These particular animals are based on a cross of the Danish Landrace and Tamworth breeds. As a type they have performed more satisfactorily in factors affecting economy of production than existing breeds of swine and in addition have produced carcasses that meet the present day standards for excellence.

Selection methods. Results emphasize that the animal breeder's efforts in selection deal with the animal as a genetic unit. Selection for one character sometimes gives rise to a change not desired by the breeder in another character. Maximum rate of fattening, for example, seems to be opposed to litter size and milking ability of sows. An index or score of net desirability based on number and weight of pigs weaned, growth weight after weaning to 5 or 6 months of age, economy of gain, and market desirability seems to be sufficiently simple and effective to be useful in selecting superior animals.

Inbreeding. A total of 60 inbred lines have been started since the laboratory program was initiated. Of these lines 14 have been dropped or are being converged into other lines because of poor performance. This experience indicates that it is probable that not more than one useful

line will result from 10 to 15 that are started. Each line must be carried far enough so that it can be tested by crossing with other lines or with non-inbred animals to determine the value of the line in a breeding program. The results also indicate the necessity of basing selection for improved animals on a family or line basis rather than on an individual hog basis which is the common practice at the present time.

Regional Sheep Breeding Laboratory: (Approved by the Secretary, February 24, 1937; located at Dubois, Idaho).

General Objective: The laboratory has as its objective the improvement of sheep for lamb and wool production under range conditions. To obtain this objective basic breeding methods are employed. Emphasis, in the breeding programs, is placed primarily on the quantity and quality of lambs produced; the length, quality and quantity of clean scoured wool; and upon the adaptability and longevity of the sheep.

Face covering. The laboratory has found that open-faced ewes produce both a higher percentage of lambs and slightly heavier lambs than ewes with wool covered faces. Results indicate that the difference in pounds of lambs weaned increased by about 4.3 pounds for each improvement of one unit in face score. Since the ewes at the laboratory usually stay in the flock for 3 lambing years, a unit change in face covering means a difference of 12.9 pounds of lamb weaned during her productive life.

Inbred lines. Matings were made in 30 inbred lines during the year. The average inbreeding coefficient of all lambs weaned in 1945 was 12.4 percent as compared with 3.2 percent in 1938. Significant differences between lines have been found in offspring groups for each of the traits measured. Results to date indicate an apparent decrease in variation within lines and an increase in the variation between lines as they become more inbred. It has been established that for practical purposes 16 weaning offspring are sufficient to evaluate rams from inbred lines.

The effects of inbreeding on yearling Rambouillet ewes were more pronounced on the mutton characters (body weight, type and condition) than on the fleece characters (staple length, grease fleece weight and clean weight). With each increase of one percent in the coefficient of inbreeding there was a decrease of 0.28 pounds of body weight, 0.02 pounds of grease fleece weight, 0.01 pounds of clean fleece weight and 0.01 centimeters in staple length.

The effect of inbreeding on face covering and neck folds was very small. The effects of inbreeding on body weight, body type and conditions were of sufficient importance to warrant adjustment before making yearling selections for animals to be continued in the flock.

Increasing accuracy of selection in yearling Rambouillet ewes. The effect of age of dam, type of birth (single or twice), year of birth, breeding group, and age at shearing were studied on 932 Rambouillet ewes. It was found that grease fleece weight, clean fleece weight, yearling body weight and staple length, which were evaluated by a quantitative standard, were more strongly influenced by environmental factors than were condition,



neck folds, body type and face covering, which were evaluated by scouring. Yearling ewes from mature dams and single births were heavier, had longer staple and produced heavier grease fleeces and more clean wool than those from 2-year-old dams and twins, respectively. With this information it was found that accuracy of selection on yearling traits could be increased by adjusting (a) staple length for type of birth, (b) grease fleece weight for age of dam, type of birth and age at shearing, (c) clean fleece weight, body weight and type score for type of birth, and (d) conditions score for age at shearing. Adjustment of face covering and neck folds score for environmental effects at yearling age was unnecessary.

Hornless condition. Definite progress is being made in removing horns in Rambouillet rams. Horns are a definite nuisance in rams of this breed and their removal will definitely improve management problems of fly attacks in open wounds and the troubles encountered in shearing horned animals. The danger from personal injury in the handling of hornless rams will be materially less than that encountered in handling horned rams.

Regional Animal Disease Laboratory: (Approved by the Secretary, February 24, 1937; located at Auburn, Alabama).

General Objectives: The laboratory program was planned to develop methods of controlling certain diseases and parasites for which practical measures had not been devised. The principles established in the original program will be used in determining the nature and methods of control of other infectious, contagious, or parasitic diseases.

Bovine Coccidiosis. The laboratory conducted a survey of 189 dairy farms, involving 1,252 cattle, to determine the extent to which coccidia were present in the region and the species of coccidia that were causing clinical symptoms of disorder. Examination of fecal samples demonstrated that coccidia were present in practically every herd. Samples from calves less than 3 weeks old had very few oocysts. In calves 3 to 12 weeks old Eimeria ellipsoidalis was the dominant species. The clinical symptoms produced by this species are a watery, non-bloody diarrhea in the younger calves. Eimeria zurnii were found in approximately fifty percent of the calves 6 weeks to 2 months of age. In the cattle from 4.5 months to 2 years old Eimeria bovis was the dominant species and was responsible for the severe bloody scours.

Under laboratory conditions much larger numbers of oocysts (3-10 million) of Eimeria zurnii were necessary to consistently produce serious infection than was the case with Eimeria bovis (100-200 thousand). Very large numbers of oocysts of Eimeria ellipsoidalis were also necessary to produce heavy infections. Calves 2 to 4 months old that had been previously infected with Eimeria zurnii, Eimeria ellipsoidalis, or Eimeria auburnensis were more resistant to Eimeria bovis than were calves not previously infected. On the other hand, calves 1 to 6 days old, showed severe clinical symptoms following dosing with 100,000 oocysts of Eimeria bovis. These results emphasize the value of correct sanitary measures in raising dairy calves.

Internal parasites. The laboratory demonstrated that phenothiazine administered at monthly intervals in doses of 20 grams per hundred pounds of body weight stopped death losses from a heavy mixed infection of roundworms in a herd of dairy calves. These results were obtained with only minor changes in the management methods in the herd.

Milk in the ration of 4 months old calves reduced by one half the number of worms found after 54 days exposure to a mixed infection of roundworms. Powdered skim milk substituted for part of the grain ration reduced the average number of roundworms by 80 percent in one group of calves. Powdered whey fed in the same manner was not effective. These findings indicate that too early weaning may frequently result in heavy infestation with roundworms and that powdered skim milk is a satisfactory substitute for fluid milk to give this needed protection.

Johne's disease. Studies were made on tissues of 298 animals that reacted to the diagnostic agent johnin. The causative agents of this disease were found to be present in 74 cases. Five cases were suspicious and 219 were negative.

Since there are thousands of soil-acid-fast organisms, it was originally thought that they might be a complicating factor in developing a specific diagnostic agent for Johne's disease. After several years work the laboratory results indicate that the soil-acid-fast organisms probably play a very small part in eliciting a non-specific reaction in animals being tested with johnin.

In field testing it has been found that roughly one-third of the animals that respond to test with johnin, also respond to test with tuberculin, the diagnostic agent for tuberculosis. These results indicate the need for a more specific diagnostic agent to determine the presence of the disease. Through cooperation with the Bureau of Agricultural and Industrial Chemistry an effort is being made to develop johnins and tuberculins which are more highly specific than those available at the present time.

Regional Laboratory for Improvement of Viability in Poultry. (Approved by the Secretary, December 23, 1937; located at East Lansing, Michigan.)

General Objectives: The program of the laboratory was planned to determine the cause of lymphomatosis, and to develop measures for its prevention and control through studies in pathology, genetics, physiology, nutrition and management.

Natural transmission. Results at the laboratory show that lymphomatosis is a communicable disease that may be transmitted through the egg and by bird to bird contact. Mortality from the disease, to 500 days of age, has ranged from zero percent for one population of 72 birds to more than 44 percent for another population of 165 birds, both lots being from the same parental stock. The eggs producing the chickens in which no disease developed were incubated and hatched by themselves in separate incubators, and the chickens were raised in complete isolation and under rigid quarantine. The eggs in the high mortality lot were incubated and



hatched with eggs from other stock on the premises, and the chickens were raised with other stock in which there was a mortality from lymphomatosis of about 45 percent in the 500-day period. These findings indicate that progress is being made in developing methods for the control of the disease, by studying various methods of raising chickens.

Transmission by inoculation. Marked progress was made during the year on the development of highly virulent tumor strains to be used for reproducing the disease by inoculation. Naturally occurring cases of lymphomatosis served as sources of material. A relatively large number of recipient chicks inoculated with lymphomatosis material developed tumors during the experimental period of 86 to 120 days. Chicks which served as controls were inoculated with "normal" tissue material that came from donors which did not manifest the disease. These birds did not show significant changes during the experimental period. The induced lymphoid tumors were both macroscopically and microscopically similar to the tumors providing the original inoculum.

Susceptible and resistant stock. Mortality from lymphomatosis among 7 lines of 683 susceptible inbred White Leghorn chickens hatched in 1945 amounted to 24.9 percent by the time the birds were 300 days of age. Losses from the disease among 7 lines of 368 resistant inbred White Leghorn birds hatched at the same time and raised with the susceptibles amounted to only 11.4 percent.

Studies are in progress to determine whether it is possible to differentiate stock resistant or susceptible to lymphomatosis by the use of chemical carcinogenic (malignant tumor) compounds. Preliminary results showed a much lower incidence of induced tumors in resistant birds than was shown by birds from susceptible lines. If these findings can be confirmed it is hoped that the technic will prove useful in the differentiation of resistant and susceptible birds at an early age and thus aid in the selection of the desired type of stock.

Incidence of the different manifestations of the disease. A study of the mortality from lymphomatosis among 3,257 White Leghorn female chickens to 600 days of age for the period 1939 to 1944 has shown that 24.4 percent of the deaths were from visceral lymphomatosis, 9.8 percent from the neural form of the disease, and only 1 percent from ocular lymphomatosis. The visceral manifestations were observed after 30 days of age and increased in frequency after this period. The neural manifestations occurred at all age periods but were most prevalent during the first 300 days of age. The relatively few cases of the ocular form of the disease occurred after 120 days of age. The greatest percentage of losses were of the visceral type, the type that cannot be diagnosed clinically.

Regional Salinity Laboratory: (Approved by the Secretary, December 23, 1937; located at Riverside, California).

General Objective: The aim of the laboratory is to develop means whereby all of this land will be suitable for the economic production of agricultural products and to devise methods for keeping the land in suitable condition for a continuing agriculture. In order to reach this objective the laboratory is studying methods of leaching salts from soils through

improved drainage, is selecting salt-tolerant crops or strains of these crops, and is determining what cultural practices will reduce salt accumulations or their effects upon plants.

Soil permeability studies. It is important to know what factors are responsible for changes in the ability of soils to absorb water in order to develop methods for improving water absorption, one of the most serious problems in the older irrigated western soils. Experiments at the laboratory have shown that increasing the percentage of sodium in a leaching solution does decrease the permeability of all soils but they also show that all soils do not respond alike to increasingly greater percentages of sodium. Results of studies with sterile soil indicate that microorganisms are one of the major causes of "soil sealing" or reduced permeability under flooded conditions. Sterile soils have maintained essentially constant rates of permeability under continued submergence for a 60-day period while the same soils when unsterilized showed a marked decrease in permeability.

Salt tolerance of plants. Six varieties of alfalfa, one of the most important crops in the western states, have been grown in sand tanks watered with solutions containing from 1,260 to 9,600 p.p.m. (parts per million) total salts. This treatment permits a study of the maintenance of stand, effect of successive cropping, and seasonal responses under saline conditions. The varieties Hegazi and California Common are showing the greatest tolerance in results so far obtained.

Similar studies with cotton varieties show that all varieties are less tolerant to sodium sulfate than to sodium chloride or calcium chloride. The varieties Acala 1517 and Shafter Acala P-18 have shown remarkable salt tolerance. The Stoneville and Egyptian varieties also show very good relative tolerance to salts. Based on these results the Division of Cotton and other Fiber Crops, BPISAE, is selecting salt-tolerant strains of Acala for high spinning quality in order to obtain cotton of good quality adapted to saline conditions.

Salt movement in a saline soil following irrigation. Preliminary experiments were conducted on plots planted to cotton and containing, on the dry soil basis, 200 p.p.m., 1000 p.p.m., and no added salt, distributed fairly uniformly to a depth of 3 feet. Following irrigation, it was found that, in the plots containing appreciable quantities of salt, water removal was more rapid from beneath the furrows than from beneath the rows. Water extraction was relatively uniform from the salt-free plots. Salt tended to move out of the furrows and into the rows upon irrigation. Conditions were thus set-up to indicate that the cotton plants were apparently "growing" in saline soil but extracting the bulk of their water needs from relatively salt-free soil. Before irrigation, plant growth response decreased as the salt content of the plots increased. After irrigation, plant growth response was largely conditioned by the degree of soil moisture depletion which took place, during an irrigation interval, within the portion of the root zone having the minimum salt concentration.

\* U. S. Plant, Soil, and Nutrition Laboratory: (Approved by the Secretary, January 1, 1939; located at Ithaca, New York).



General Objective: Through basic research this laboratory is determining the role of soils in supplying to man and animals, through plants grown on them, the nutritional factors required for normal health and well-being. Physiological disorders of man and animals in certain sections of the country have been identified as a deficiency of one or more essential nutrients in the food or feed eaten. In order to provide adequate nutrition for our entire population it is necessary to define the areas that are supplying inadequate food and feeds to the men and animals dependent upon these areas for their subsistence. In the case of areas supplying inadequate food and feeds it is essential to know the nature and extent of the deficiency so that it may be corrected.

Cirrhosis of the liver. Studies at the laboratory have shown the cirrhosis of the liver in rabbits is due to malnutrition, but in spite of extensive tests the specific dietary factor involved remains undiscovered. The feeding of a milk diet to rabbits results in almost a 100 percent incidence of the condition. Soybean hay feed in addition to a milk diet results in normal livers, indicating that soybean hay contains the protective factor. On the other hand, such nutrients as yeast, liver extract, all the crystalline B vitamins, a mixture of 16 mineral elements, and the tocopherols when fed as supplements to a milk diet were without effect. Removal of milk fat from the diet has no effect on the incidence of cirrhosis.

This is an important problem inasmuch as extensive work has been done to determine the cause and prevention of cirrhosis of the liver of man, but with little success. The director of public health of South Africa, during a recent visit to the laboratory, stated that cirrhosis among the native population was one of the biggest problems faced by the medical profession. He also brought out that the principal diet of these natives was corn meal and milk.

Vitamin C studies with potatoes. During the year the laboratory has found that the vitamin C content of different varieties and strains of potatoes varied over a range from about 6 to 25 mg. per 100 grams of fresh tuber. During 6 months of storage, some varieties decreased rather rapidly in vitamin C content, while others decreased very little. Fortunately, some of the varieties which were relatively high at harvest decreased but little in vitamin C content during storage and would thus be especially valuable as sources of vitamin C.

Potatoes are relatively low in vitamin C as compared with citrus fruits and tomatoes, but because of the volume of consumption they constitute an important source of this vitamin in our national diet. A careful breeding program might greatly increase the average vitamin C content of our annual potato crop.

Nutritional troubles in livestock. Results obtained at the laboratory make it evident that many of the problems of breeding and raising cattle and sheep are related to a deficiency of cobalt in forage. Detailed surveys of troubles in cattle in a county in North Carolina indicate a cobalt deficiency in the forages and in the soil. In this area milk cows particularly are affected. Similar results were obtained in a

county in New York. In this latter area sheep do not thrive at all and in many cases they do not survive. As the cobalt study continues to collect information the deficient areas seem to be much more widespread than was first suspected. Defining these deficiency areas will make it possible to advise farmers as to the best means of combating nutritional problems in livestock.

The laboratory has found that a deficiency of copper in the diet of rabbits, in addition to causing an anemia, leads to a graying of the hair, loss of hair and a dermatosis. All these conditions are completely cured or prevented by feeding the animals sufficient copper. Rabbits fed hays from so-called "sick" areas where grazing cattle consistently fail in health, developed a high incidence of gray hair. If this observation can be confirmed, it will mean that the hays of these "sick" areas are deficient in copper.

#### Special Research Projects:

Part of the Special Research Fund is available to the Secretary of Agriculture for special research projects. This part of the fund is intended primarily to enable the Secretary to undertake studies which are basic to agriculture in its broadest aspects and which may be conducted by such agencies of the Department as he may designate or establish. The act requires that the research under this fund "shall be in addition to research provided for under existing law (but both activities shall be coordinated so far as practicable)". The solution of many problems which arise requires research of fundamental character in order that further progress may be made. The appropriation enables the Secretary to undertake such work within the limits of available funds.

In administering, budgeting, and using the Special Research Fund, no money is allotted to the bureaus which conduct the research until carefully written project plans and cooperative arrangements are outlined in detail and approved by the Secretary. Allotments are adjusted on the basis of changes in relative needs of the projects which are under way.

Examples of Progress and Current Programs: During the eleven years that the Special Research Fund has been available, 112 separate research projects have been undertaken and 79, constituting 70 percent, have been terminated. Of those terminated, 37 were relatively short-time studies designed to provide information for immediate needs. Of the other 42 projects, 11 were terminated in 3 years, 7 in 4 years, 3 in 5 years, 7 in 6 years, 4 in 7 years, 5 in 8 years, 3 in 9 years, 1 in 10 years, and 1 in 11 years. Seven projects were terminated in 1946. A total of 33 projects, involving 8 bureaus, are now under way.

The majority of these projects are concerned with fields of work basic to agriculture in its broadest aspects. As the work progresses and the needs vary, changes in emphasis are made from year to year. With the completion of one phase of a problem, the attack may be directed to another phase requiring solution.



The following are examples of progress made in special research projects during the fiscal year 1946:

Biologically active chemical compounds in growing plants. Investigations were continued to isolate and purify the chemical compound, previously reported, which exhibited marked fungistatic activity toward the wilt organism in the tomato plant.

During the year it was established that this product, now known as "tomatin" was present in highest concentration in tomato leaves, to a lesser extent in the roots, and least in the stems and fruit of the tomato plant. While tomatin has not been isolated in pure form, it has been prepared in sufficient concentration to use in studies to determine its potency. The leaves of the Red Current tomato plant are the richest source of tomatin so far discovered, but for practical purposes, whole plants of any commercial variety of tomato may be used as a source of the product. It has also been established that the antibiotic effectiveness of tomatin is not limited to the organism that causes tomato wilt. Tomatin inhibits to an equal degree, cultures of the fungi that cause wilt in peas, wilt in flax and cabbage yellows. It is also highly effective against the bacillus that is responsible for bacterial wilt in tomatoes, and moderately effective against the organism that is associated with scab disease in potatoes.

Data has been accumulated to show that plants, other than the tomato plant, may produce tomatin or tomatin-like substances, to be used for protective purposes in resisting the attacks of disease-causing organisms. The autoclaved juices of sweet potato plants (including the roots), potato plants (but not the tubers), chili pepper plant, and cabbage leaves, exhibit marked tomatin-like activity. On the other hand, tomatin-like substances appear to be absent in the juice of lettuce, cucumber, jimson weed, dandelion, clover, plantain, grass and lima beans.

These developments strongly indicate the possibility that the elaboration of antibiotic agents by growing plants is a factor of fundamental significance in the plant disease picture. If the plant breeder can incorporate the ability to produce protective substances into improved strains and varieties of economic plants the problems of production will be greatly simplified.

A starch converting enzyme. A starch converting enzyme or diastase was extracted from wheat during the war and used to fertify poor quality malt during the period when alcohol was being distilled from wheat.

During the past year, it was found that a great quantity of this enzyme was present in sweet potatoes. Further study revealed that the juice of sweet potatoes, obtained by simple pressing, contained a large quantity of the same substance. Since the starch of the sweet potato remains in the press, and is considered the valuable part of the plant, it may develop that the juice will become a very cheap and practical source of diastase.

The sweet potato diastase has been purified until it crystallized. This is the first carbohydrate-splitting enzyme ever to be obtained pure and crystalline and its present form is considered a major scientific achievement. The use of this substance should contribute to the solution of several important scientific problems, among them the constitution of starch.

Improvement in the Navajo sheep. In this study the type of sheep best adapted to the economic needs of the Navajo Indians is being determined. Consideration is given to the adaptability of the sheep to local conditions, the limitation of range resources, the need for wool suitable for both handicraft and market requirements, and to lambs of satisfactory size and type.

Breeding and selection during a period of nine years has resulted in improvement in several important respects. For example, there has been an increase in average body weight of mature ewes at breeding time from 95 pounds to about 110 pounds. The average fleece weight (scoured basis) has increased about 38 percent for yearling ewes and 28 percent for mature ewes as compared with the records of the foundation stock. Improvement in the fleeces produced is shown by the fact that the average amount of kemp has been reduced from 2 percent to 0.54 percent, medullated fibers from about 9 percent to 0.65 percent, and outer-coat fibers from 17 percent to 8.1 percent for mature breeding ewes. These changes have markedly improved the suitability of the wool for hand weaving.

During the nine-year period there has been an increase of 18.4 percent and 5.9 percent in the numbers of lambs born and weaned, respectively, per 100 ewes bred. The average weaning weight of lambs increased 3.2 pounds, and the weight of lamb produced per ewe lambing increased 9.2 pounds. A portion of this latter increase was due to the fact that the number of multiple births increased 24.5 percent.

The results of this research are being put into practical use on the Navajo reservation as rapidly as conditions will permit. The Indian Agency has closed two districts in the Navajo Mountain Area to permit the use of laboratory rams under controlled conditions. No rams of outside breeding will be permitted in this area.

Storage of soybeans on the farm. This investigation has been continued to ascertain what conditions are necessary in order to store soybeans successfully on the farm.

It has been found that there were no market grade changes in soybeans with an initial moisture content of 11 percent or below after 860 days in storage. The germination of this grain had changed but little and there was almost no increase in the percentage of damaged kernels. On the other hand, soybeans stored with an initial moisture content above 13 percent were sometimes graded "sample", the lowest market grade, after only 300 days in storage.

Wind-ventilated bins have not been effective in drying out high moisture soybeans in tests conducted during the winter and spring of 1944 and 1945. Limited tests were made using only the heat produced by a gasoline



motor, operating a fan, for raising the temperature of the air delivered to stored soybeans. It was estimated that the fan delivered from 40 to 50 cubic feet of air per minute per square foot. About 33 pounds of water were evaporated per hour of fan operation.

A considerable amount of damaged soybeans were found in wood framed bins constructed in the conventional manner with a single layer of matched wood siding. The most damage prevailed in bins where the following conditions prevailed:

Shrinkage cracks between boards, apparently due to the use of unseasoned lumber in construction; defects in the siding, such as splitting or large loose knots; car-siding laid horizontally in the walls; several end joints occurring on the same stud; relatively high walls and narrow eaves on shed roof bins allowing roof drainage to run down walls.

Crossbreeding dairy cattle. Further information has been added to existing knowledge which will guide the farmer in determining the proper matings when practicing the crossbreeding of dairy cattle.

At the present time, 35 of the 2-breed crosses have completed their first lactation records. The average production of the 35 animals, calculated to a mature basis, is 17,754 pounds of milk, containing 811 pounds (4.57 percent) of butterfat. On a mature equivalent basis, they exceed the production of their dams by 4,028 pounds of milk and 198 pounds of butterfat.

Six females of various 3-breed combinations have now completed their first lactation records with an average production, calculated to a mature basis, of 20,804 pounds of milk containing 919 pounds (4.42 percent) of butterfat. These records exceed the production of their 2-breed dams by 2,991 pounds of milk and by 124 pounds of butterfat.

While not conclusive the results obtained to date indicate that by proper selection of parent stock of known producing ability the farmer need not suffer a loss in milk yield by following a crossbreeding program.

Extraction of foreign material from cotton lint at gins. The successful adaptation of mechanical harvesting of cotton depends to a great extent on the development of equipment for removing extraneous matter from lint at gins so that a grade comparable to hand-picked cotton can be obtained.

Preliminary results have led to the conclusion that (1) mechanical means must be employed to dislodge the particles of trash firmly entwined with the lint fiber as a process step in the cleaning of lint cotton, and (2) pneumatic pressure or suction means should be applied to the gin saw cylinder to remove trash particles from contact with the fibers.

An experimental cleaner has been devised in which mill type beaters and bar grids have been introduced in the ginning process. A double beater serpentine bar grind cleaner used in preliminary tests showed that the cleaning done by this machine would enhance the value of the cotton so processed.

Administration of Payments to States under Title I, Bankhead-Jones Act

During the fiscal year 1945, the administration of the provisions of title I of the Bankhead-Jones Act of June 29, 1935, which authorized payments for agricultural experiment stations, involved:

(a) Critical examination and approval, in advance of the expenditure of funds, of research projects, there being 1,348 active Bankhead-Jones projects during the fiscal year, of which 194 were either new or revised.

(b) Review in the field of the work and expenditures at the State agricultural experiment stations under funds totaling \$2,663,708 provided under title I of the Bankhead-Jones and apportioned on the basis of rural population.

(c) Review in the field of research and research facilities of the stations supported by \$2,663,708 from non-Federal sources advanced as offset credit to meet the requirements of Section 5 of the Bankhead-Jones Act.

(d) Special examination of any expenditures from the allotments under the Bankhead-Jones Act made for the construction, equipment, and maintenance of buildings and purchase and rental of land to ascertain that such expenditures were necessary for the research supported by the funds provided by the Bankhead-Jones Act.

(e) Assisting in coordinating the research under this Federal-grant fund between the State stations and with the research of the Department, and maintaining advisory relations with the State stations on technical and administrative matters pertaining to their research programs and station organization.

(f) Reporting to the Secretary and the Congress on the work and expenditures under this Federal-grant fund.

Specific examples of the type of work done under this project are given below in the statement for the Office of Experiment Stations under the appropriation "Payments to States, Hawaii, Alaska, and Puerto Rico for Agricultural Experiment Stations" and under the subappropriation for administration of grants to States.

RESEARCH ON STRATEGIC AND CRITICAL  
AGRICULTURAL MATERIALS

As the Budget Estimates for this item represent the first estimate for an appropriation pursuant to the provisions of Section 7(b) of the Strategic and Critical Materials Stock Piling Act, approved July 23, 1946 (Public Law 520), all information pertaining thereto is included in the Digest of Budget Estimates.





OFFICE OF EXPERIMENT STATIONS

(a) Payments to States, Hawaii, Alaska and Puerto Rico

General: The several appropriations under "Payments to States, Hawaii, Alaska, and Puerto Rico for agricultural experiment stations" represent the Federal Government's support to the State, Territorial, and Puerto Rican agricultural experiment stations which are established as departments in the land grant colleges pursuant to the provisions of the Hatch Act of 1887.

The primary function and obligation of the State agricultural experiment stations is to meet the needs of the farmers of the several States through study and solution of State and local agricultural problems. This function is expressed in the Hatch Act of 1887 and the Adams Act of 1906 which specify that the investigations conducted shall be with "due regard to the varying conditions and needs of the respective States and Territories."

In addition to their function of serving State and local needs, the research programs of the State stations, to be most effective, include participation in regional and national programs. Research programs of the State stations and the research of the United States Department of Agriculture are supplementary and interdependent, the Department of Agriculture having primary responsibility concerning the agriculture for the country as a whole, whereas the State stations have responsibility regarding agriculture primarily in relation to local needs and requirements in the various climatic and type-of-farming areas within their respective States.

Value of Experiment Station Research: There is general recognition by farmers as to the need and value of agricultural research as done by the experiment stations and the Department. The following are some values that have been realized by farmers:

FLORIDA--Correcting mineral deficiencies for livestock and crops; citrus pulp recovery; new crop plants and varieties; disease control; etc. A total of 19 items, 1944 ..... \$52,775,000

KENTUCKY--Replacement of old types of burley tobacco with disease-resistant, better quality varieties, 1945 ..... \$20,000,000 to \$30,000,000

MONTANA--Increased livestock production through revegetation of abandoned range land resulting from research on crested wheatgrass, 1945 ..... \$2,000,000

MISSOURI--Improvement, development, and management practices of pastures with resulting gain in production of feed for livestock, 1945 ..... \$30,000,000

<u>IOWA</u> --Disease-resistant oat varieties, Boone, Tama, Control, and Marion, grown on 98 percent of oat acreage with increase of 32 percent in yield, 1945.....		\$34,000,000
<u>INDIANA</u> --New disease-resistant, high-yielding varieties of oats, increase of 7 million bushels, 1945.....		\$5,000,000
<u>KANSAS</u> --Kawvale wheat and Fulton oats, 1942-45.....		\$10,500,000
Osage, Neosho, Boone, Tama, and Cedar		
oats, 1945.....		1,700,000
Comanche wheat, 20,000 acres in 1945.....		40,000
Pawnee wheat, 40,000 acres in 1945.....		200,000
<u>KANSAS AND TEXAS</u> --Disease-resistant milos grown on 19,500,000 acres in the central and southern plains area, 1941-45.....		\$175,000,000
<u>NORTH CAROLINA</u> --Increased market value of Massey variety of strawberry, 81,673 crates at \$1.52 per crate, 1946.....		\$124,000
<u>DELAWARE</u> --Plowing down fertilizer for tomatoes by 30 percent of growers with increased yields of one ton per acre, 1945.....		\$180,000
<u>OREGON</u> --Increased yield of hops through use of sprinkler irrigation on 5,000 acres in 1945.....		\$690,000

These research results are merely brief examples of accomplishments through research which have been evaluated and reported to the Office of Experiment Stations. The annual report to Congress on the work of the stations summarizes results more completely.

Examples of new research findings that had reached the stage of public application during the past year:

Further development of potato spray materially increases yield (Delaware Station).--Further studies by the Delaware station with supporting evidence from other States confirmed previous conclusions that the development of Dithane-zinc sulphate-lime spray for potatoes is a major milestone of progress in potato production. The new spray material is effective against the two important foliage diseases of potatoes, early blight and late blight. The complete freedom from injury to potato plants through its use also contributes to high yields. An important finding in the 1945 Delaware tests is that the reaction product of Dithane and zinc sulfate may prove an even better fungicide than the two materials mixed in the spray tank. The reaction product (chemically, zinc ethylene bisdithiocarbamate) is a white powder that wets readily with water without foaming and stays well in suspension. Under severe early blight conditions in 1945, it produced the highest yield of nine materials tested by the Delaware station and increased the yield of Dakota Red potatoes more than 100 bushels per acre over the yield of unsprayed plants.

Increase in pasture season saves Missouri farmers \$30,000,000 annually in feed costs (Missouri Station).--By adopting research results of the Missouri station on the improvement and development of pastures, farmers in that State have been able to step up the pasture season to seven and one-half months. This is an increase of one and one-half months over the normal six months pasture season. The additional feed obtained through this extra period on the improved pastures is equivalent to that obtained from 37 million bushels of corn, or nearly one-fourth of the average corn crop of the State. Missouri pasture land now exceeds corn in total feed production by the equivalent of 31 million bushels, the total pasture production being estimated as the equivalent of 184 million bushels of corn. When corn is worth 80 cents per bushel, the annual benefit to Missouri farmers through the application of these research findings amounts to almost 30 million dollars.

Research on streptomycin (New Jersey Station).--A great deal of research as to uses and methods of manufacture of streptomycin has followed the discovery and purification of this antibiotic by the New Jersey station. Evidence presented by the station and summarized in last year's examples showed streptomycin to have promise for the treatment of important diseases of man and animals caused by bacteria that are resistant to penicillin or sulfa drugs. The Streptomycin Producers Advisory Committee representing 11 pharmaceutical manufacturers has made available through the National Research Council more than a half-million dollars as grants-in-aid for clinical study of the new drug. Commercial production which has increased in recent months will be further accelerated in a \$3,500,000 plant under construction.

New varieties of tomatoes (Hawaii Station).--At the Hawaii station, a newly discovered method for producing spores of the fungus (*Stemphylium solani*) which causes the destructive gray leaf spot disease has greatly speeded the program to produce disease resistant varieties of tomatoes. New varieties, better than Pearl Harbor and resistant to two or more diseases, are being tested by farmers. Practically all tomatoes now grown in the Territory were originated by the station.

Increased use of colostrum milk (Ohio Station).--As commonly practiced, new born dairy calves are allowed to nurse their dams for a few days, during which period the colostrum milk not consumed by the calf is milked out and discarded. Recent studies by the Ohio station and elsewhere have shown that colostrum has special nutritive properties. It promotes rapid growth, builds up vitamin A reserves, and reduces calf mortality. Saving the colostrum not consumed during nursing and feeding it to other calves would not only result in better calves but if generally practiced would release an estimated 150,000,000 pounds of whole milk annually for human use.

Improved varieties of sweetpotatoes (Louisiana Station).--Because of the improved varieties of sweetpotatoes developed by the Louisiana station and the resulting high quality seed stock, the State of Louisiana produced over 10 million pounds of dehydrated sweetpotatoes for the Army and allied agencies in 1945. Louisiana farmers also supplied certified seed for in-State use and 8,000 cars for shipment



to other States in that year. Canning of sweetpotatoes is carried on in 10 factories with more in prospect. Pelican Processor, analyzing 25 to 36 percent of starch, is one of the new station varieties contributing to this development. Three of the new high carotene seedlings for table use and dehydration have twice the carotene content of the standard Puerto Rico variety.

Better condensed milk (Michigan Station).--Research at the Michigan station has developed a procedure whereby homogenized milk can be condensed to one-third or one-half its original volume and then be reconstituted by the addition of water without apparent change in taste, appearance, or other qualities. In the condensed form, the homogenized milk can be held for several times the normal holding period for ordinary raw milk. This finding promises to be well adapted to commercial use and should effect a very substantial reduction in distribution costs for fluid milk.

Crested wheat grass better than native grass for Montana pasture (Montana Station).--A little more than two decades ago crested wheat grass, a winter-hardy, drought-resistant forage crop from Siberia, was made available to Montana livestock growers through the cooperation of the Montana station and the Department. According to the station, this grass has now been seeded on about one million acres of abandoned crop land in the State and has added about \$2,000,000 to the income of the livestock operators. The acceptance and widespread use of crested wheat grass in Montana comes from cooperative pasture experiments where it has produced an average of 78-1/2 pounds of beef per acre per grazing season, or about 42 pounds more than good native pasture.

Volume of State Station Work: The investigational work of the State experiment stations was carried on during 1946 under a total of 3,505 research projects financed wholly or in part by the Federal-grant funds. In addition, 4,808 projects were active under the non-Federal funds available to the stations from State appropriations, research grants, and other sources.

The volume of cooperative work is indicated by the number of formal memoranda of understanding active between one or more stations and the Department which totaled 1,168 in 1946. This figure by no means shows the total volume of the cooperative effort. There were many studies active between stations not covered by the formal memoranda cleared through the Office of Experiment Stations and much informal exchange of information.

By the end of the fiscal year 1946, the technical manpower situation had returned to near normalcy. Many veterans returned to former positions and others were employed as new staff members. All told, wartime personnel losses which reduced prewar totals by some 605 professional workers were recouped to the extent of about 75 percent.



Financial Support: The Federal-grant funds for the State agricultural experiment stations are authorized by the Hatch Act, the Adams Act, the Purnell Act, and Title I of the Bankhead-Jones Act of June 29, 1935.

The several appropriations under "Payments to States, etc." provide annually for each State agricultural experiment station \$15,000 under the Hatch Act; \$15,000 under the Adams Act; \$60,000 under the Purnell Act; and for the fiscal year 1947, \$2,663,708 under the Bankhead-Jones Act of June 29, 1935, to the States, Territories, and Puerto Rico, apportioned primarily on the basis of rural population.

In addition to this Federal support, each of the State, Territory, and Puerto Rico experiment stations receives financial support from the State in which located. For a number of years, the support received by these stations from non-Federal sources has exceeded Federal appropriations.

Total expenditures by the various State and Territorial agricultural experiment stations from both Federal and non-Federal funds during the fiscal year 1946 are indicated in the following table:

(Continued on next page)

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Expenditures by Stations - Fiscal Year 1946

	Federal	Non-Federal	Total
Alabama.....	\$ 179,423.98	\$ 472,327.42	\$ 651,751.40
Alaska.....	44,940.15	35,342.52	80,282.67
Arizona.....	104,392.26	167,783.46	272,175.72
Arkansas.....	158,648.70	197,624.90	356,273.60
California.....	178,718.14	1,758,805.12	1,937,523.26
Colorado.....	114,243.47	278,456.55	392,700.02
Connecticut, State...	56,042.07	175,456.78	231,498.85
Connecticut, Storrs...	52,105.06	74,622.36	126,727.42
Delaware.....	93,905.03	132,874.68	226,779.71
Florida.....	127,680.70	1,095,887.40	1,223,568.10
Georgia.....	184,499.88	230,120.42	414,620.30
Hawaii.....	99,727.88	276,253.08	375,980.96
Idaho.....	105,404.82	75,597.19	181,002.01
Illinois.....	183,841.72	802,393.07	986,234.79
Indiana.....	153,186.65	819,515.70	972,702.35
Iowa.....	159,803.53	599,760.58	759,564.11
Kansas.....	143,614.75	311,021.78	454,636.53
Kentucky.....	178,327.80	346,340.79	524,668.59
Louisiana.....	151,211.39	384,007.50	535,218.89
Maine.....	112,408.10	200,800.88	313,208.98
Maryland.....	122,756.90	176,206.27	298,963.17
Massachusetts.....	110,231.15	221,003.67	331,234.82
Michigan.....	169,697.18	395,392.42	565,089.60
Minnesota.....	152,041.49	615,528.47	767,569.96
Mississippi.....	168,610.70	411,671.29	580,281.99
Missouri.....	173,175.72	228,621.81	401,797.53
Montana.....	106,687.31	316,781.19	423,468.50
Nebraska.....	131,505.16	370,953.63	502,458.79
Nevada.....	92,962.52	26,862.87	119,825.39
New Hampshire.....	99,216.35	12,211.94	111,428.29
New Jersey.....	123,865.35	675,608.19	799,473.54
New Mexico.....	105,725.69	72,793.86	178,519.55
New York, Cornell....	172,681.91	1,064,052.96	1,236,734.87
New York, State.....	19,176.48	504,179.53	523,356.01
North Carolina.....	204,926.05	348,028.30	552,954.35
North Dakota.....	116,411.54	209,611.30	326,022.84
Ohio.....	190,343.58	686,003.45	876,347.03
Oklahoma.....	163,409.01	498,306.98	661,715.99
Oregon.....	114,689.53	548,574.79	663,264.32
Pennsylvania.....	236,599.59	428,446.59	665,046.18
Puerto Rico.....	147,647.71	324,870.93	472,518.64
Rhode Island.....	92,508.94	31,244.57	123,753.51
South Carolina.....	154,344.59	532,293.21	686,637.80
South Dakota.....	116,082.74	104,762.29	220,845.03
Tennessee.....	173,564.08	205,403.06	378,967.14
Texas.....	251,288.81	978,810.70	1,230,099.51
Utah.....	100,677.74	140,129.42	240,807.16
Vermont.....	101,274.80	26,190.51	127,465.31
Virginia.....	167,043.23	298,494.75	465,537.98
Washington.....	126,025.87	531,191.18	657,217.05
West Virginia.....	150,514.12	154,782.39	305,296.51
Wisconsin.....	155,188.75	1,093,855.00	1,249,043.75
Wyoming.....	97,294.44	118,994.50	216,288.94
Total.....	\$7,190,295.11	\$20,786,854.20	\$27,977,149.31

(b) Administration of grants and coordination of research with States

General: The Office of Experiment Stations represents the Department of Agriculture in the administration of the Acts of Congress (Hatch Act, Adams Act, Purnell Act, and the Hawaii, Alaska, and Puerto Rico Station Acts), authorizing appropriations for research by the agricultural experiment stations of the 48 States, Alaska, Hawaii, and Puerto Rico. The Office also administers the Federal Experiment Station in Puerto Rico and coordinates the work of this station with that of the experiment stations of the University of Puerto Rico as required by the Congressional Act.

In carrying out the purposes of the foregoing acts, the Secretary of Agriculture has responsibility for suggesting to the experiment stations lines of inquiry consistent with the acts that seem most important, and for furnishing advice and assistance in organizing, planning, and coordinating research. He also is charged with ascertaining whether the expenditures of Federal-grant funds by the experiment stations are in accordance with the provisions of the acts, taking fully into consideration the varying conditions in the different States and Territories, of coordinating the research work of the experiment stations under the acts with similar research of the Department, and of reporting annually to Congress on the work and expenditures of the experiment stations under these acts. The procedures essential to carrying out the foregoing responsibilities have been established over the years, often with the advice of the directors of the stations, who have given consistent support to measures designed to promote and strengthen the purposes of the acts.

Procedure for Administering Federal-grant Funds: In large measure, the Federal-grant funds are spent for the support of research projects outlined and proposed by the stations under the authorizations in the several acts and approved by the Office of Experiment Stations. Suggestions as to scope and details of the research project proposals and coordination of the research are a part of the approval procedure. Major follow-up of the approved research projects is accomplished by means of annual conferences between representatives of the Office and the project leaders at the stations. Progress, results, and future plans are discussed and suggestions offered. Written progress reports are submitted annually by the research project leaders as a continuing record of the research and for use in establishing status and for possible further coordination. All expenditures of Federal-grant funds are reviewed annually as to compliance with the provisions of the acts by representatives of the Office of Experiment Stations during the annual visits to the stations. The stations transmit a financial report and the Office includes this information together with an account of the principal results of station work of the year in the annual report to Congress.

Volume of Work: In the fiscal year 1946, the Office reviewed and approved 507 new and revised project proposals under Federal-grant funds; reviewed progress of the year on a total of 3,505 active projects in conferences with project leaders at the stations; reviewed research offset funds of State origin representing expenditures of \$2,663,708 equivalent to the allotments to the States of Bankhead-Jones research funds; reviewed all station expenditures of Federal-grant funds; and approved the annual programs and budgets of proposed expenditures of these funds.



Responsibility for assistance in coordinating the research of the stations under Federal-grant funds with that of the Department is met in part through suggestions by the Office during the review of research proposals by the stations, and in part through the examination and approval by the Office of formal memoranda of understanding. A total of 1,168 such documents were approved in 1946. Further aid is given by means of conferences with directors or research workers in specific subject matter fields in regional groups or individually.

Examples of Activities During the Year in Coordinating Research:

Assistance in development of coordinated study of production adjustments in the South.--The directors of the Southern regional group of States with the participation of the Chief of the Office discussed and agreed to a regional cooperative study dealing with production adjustments to improve farming opportunities in the South. The Office prepared and transmitted to each of the directors a skeleton project outline incorporating the principles that had been discussed for use in formulating project proposals under the Federal-grant funds. By the end of the fiscal year 1946, four stations had begun work on approved projects. Others were acquiring needed information under existing projects, or were planning new work to begin in 1947.

Help in coordinating DDT research.--During the several inter-departmental conferences relating to the possible toxicity of DDT to farm animals, the need was expressed for early and more complete information as to the accumulation in meat or in milk and eggs of residues from the treatment of feed or forage crops with DDT. The Office cooperated with the Bureau of Entomology and Plant Quarantine in preparing an outline of suggestions for needed research on this subject. Copies were sent to the station directors and other public agencies interested in the general problem. Many stations responded by asking for suggestions as to specific research they might undertake to help secure the needed information and avoid unnecessary duplication. The Office in turn advised the stations as to work in progress and suggested local problems that they might undertake. Due in part to these efforts, a fairly well-rounded program was in progress during the year.

Digest of results of fungicide research.--As an aid to investigators in plant disease work, a member of the staff of the Office helped bring together information on experimental progress with some of the newer fungicides. A digest was prepared of the results of research conducted during 1945 in 38 States and Hawaii, covering experimental trials of 14 new fungicides on some 47 different kinds of plants, seeds, and planting stock. Needed additional research as to factors that influence safety to plants and efficiency of the chemicals was indicated by the variations in performance recorded in the data.

Coordination of nutrition research.--The Office continued to function in an overall coordinating capacity for the National Cooperative Project on Conservation of Nutritive Value of Foods, participating in the discussions and plans of regional groups of directors and project leaders and by acting as a clearing house for information. A history of the project and a list and index of the commodity reports were prepared by the Office and transmitted to the cooperators.



Plans for cooperative animal pathology research.---Preliminary plans for the closer coordination of research on disease and parasite problems affecting the major classes of livestock were inaugurated during the year by directors and research workers of 13 Southern States and representatives of the Department, including the Office of Experiment Stations. The general agreement reached by the group is expected to result in definite research projects for cooperative study.

Development of cooperative research in beef cattle breeding.---Progress was made among the ten range States toward the development of cooperative research for the improvement of beef cattle through breeding. Specific research projects were being formulated. The Office assisted through conferences with the coordinator of the regional program.

Assistance with research on cotton.---An important activity of the year involved the assembly, analysis, and summary of information pertaining to the current research program related to cotton and needed additional research in this field. In cooperating with the experiment stations of the ten major cotton-producing States, the Office prepared summary tables showing allotments by States of Federal-grant and State funds for research on cotton and related problems, and the total allotments for all agricultural research at these stations. The latter phase involved extensive review of research in all subject matter fields. In addition, the Office prepared estimates of allotments for research on cotton and related problems in four additional States that produce appreciable quantities of cotton. The foregoing information was obtained at the request of the Pace subcommittee of the House Committee on Agriculture appointed to study and formulate programs and policies for agriculture, particularly in the postwar period.

Twelve monthly issues of Experiment Station Record were prepared by the Office and published during the year as a means of aiding research. Nearly 7,000 abstracts of research publications were issued during the year. With the modification of war restrictions, distribution of the Record abroad was resumed to most countries from which service was suspended in 1942. Exchange relationships were developed in close cooperation with the program of the State Department.

Miscellaneous.---The Office assisted the stations throughout the year by transmitting information on a variety of subjects of current interest to them. Such as, for example, information as to the availability of and how to obtain 1945 census of agriculture data by minor civil divisions. As a help in maintaining exchanges of research publications with foreign institutions, the Office transmitted a corrected list of currently active institutions in Czechoslovakia prepared by the Department Library to be followed by similar lists for other countries.

(c) Federal Experiment Station, Puerto Rico

Functions: The agricultural research program of the Federal Experiment Station in Puerto Rico is devoted mainly to the solving of problems in tropical agriculture of primary concern to the continental United States and to the Caribbean and other tropical American areas. The three primary functions of the station may be broadly classified as follows: (1) Research on tropical crops of economic and strategic importance to the continental United States, (2) cooperation with other bureaus of the Department in making the facilities of the station available in furtherance of their research programs, and (3) cooperation with other agencies in the development of the Caribbean and Latin-American program.

Examples of Past and Current Activities: The station program is divided into seven major lines of work which are discussed more fully below:

Insecticidal Crop Investigations. Rotenone, an insecticide toxic to insects but harmless to man and domestic animals, continues to be a scarce material in heavy demand by American farmers for crop protection. This product was formerly obtained from the Far East and in small quantities from South America.

Experiments during the fiscal year 1946 show clearly that rotenone content alone should not be used in evaluating insect killing power of insecticidal plant material. To date evaluation of this material has always been made on the basis of rotenone content.

Previous to the war a high percentage of the rotenone used was prepared from roots of Derris grown in the Far East. During the war period, practically all of the raw material used in the manufacture of rotenone was obtained from Lonchocarpus grown in South America. Even though it contained the same amount of rotenone, it did not give the expected results in the control of various insect pests. Investigations, in cooperation with the Bureau of Entomology and Plant Quarantine, show conclusively that toxicity of killing power cannot be based on rotenone alone and that other substances, known as rotenoids, are in a large part responsible for the resultant kill. More extensive investigations of this rotenoid group of compounds are contemplated.

Cooperation with the Office of Foreign Agricultural Relations has been continued during the year and a replicated evaluation experiment of the nine highest known clones of Derris elliptica were planted in Puerto Rico and in Guatemala for comparative test purposes.

A total of 25 plants have now been investigated to determine insecticidal value. From one to nine parts of each were tested under laboratory conditions. The common tropical plant, Mamey, continued to be the only promising one found to date. The seeds of Mamey have been found to be highly toxic to a number of common insects and comparable to rotenone in the field control of certain insects. The toxic principle in seeds of Mamey was isolated and similarities to pyrethrum flowers were observed.

Drug Crop Investigations. Quinine obtained from Cinchona bark is used and will continue to be used extensively in the cure of malaria, even though several promising synthetics have been developed. The work of the Federal Experiment Station in Puerto Rico has concentrated on the development, selection, and maintenance of high-yielding strains of Cinchona and on problems of growing this crop.

The station has cooperated with the Defense Supplies Corporation on a project to propagate and maintain under the American flag the highest known yielding strains of Cinchona. Several thousand trees are now well established in the mountains of Puerto Rico and will serve as a source of seed and planting material. Experiments in air-conditioned greenhouses showed that small differences of 5 to 10 degrees F. in environmental temperature had a profound effect on the growth of the two most important species of Cinchona.

Permanent field plantings of Cinchona show a definite response to applications of complete chemical fertilizer. The mulching of plants proved to be detrimental due to the increase of disease. The staking and tying of seedlings resulted in higher survival and prevented wind damage.

The results of these investigations are being made available to other Government agencies interested in the establishment of Cinchona in the Western Hemisphere.

Food Crop Investigations. Lack of sufficient and proper food is a basic factor limiting improvement in the standard of living of tropical peoples. During the past two years, the standard varieties of vegetables commonly grown in the southern United States, Puerto Rico, and Hawaii were tested as to their adaptability. These tests were run at 2,000 feet elevation, 3,200 feet elevation, and sea level. It was found that almost all vegetables planted during the summer months grew poorly due to high night temperatures and excessive rainfall. In general, the cole crops did better at the higher altitudes. Some of the standard varieties proved to be adapted to certain types of tropical conditions but need was indicated for the development of varieties particularly adapted to the Tropics.

The Station has assembled and maintained for many years a large collection of avocado varieties, particularly Mexican and Guatemalan types which fruit at a time when local avocados are unavailable. In cooperation with the Puerto Rico Agricultural Company, the station grew and grafted some 5,000 avocados for the establishment of a commercial planting of these new types.

The station also has a large collection of introduced mangoes. In cooperation with the Puerto Rico Agricultural Company, over 15,000 seedlings of the better mango varieties were grown. Also, some 2,000 introduced varieties of citrus, particularly oranges and limes, were propagated. In addition to the propagation of this material, studies were made on the effect of stock-scion relation, methods of budding and grafting, and cultural conditions best adapted to the production of these tropical fruits.

Close cooperation was maintained with the Caribbean Commission, established to improve conditions in the Caribbean area.



Plant Introduction and Propagation. The collection and maintenance of a plant introduction garden has been one of the major activities of the station since its establishment. The number of plants introduced is now nearly eight thousand and represents species from all over the tropical world.

Tropical Kudzu, an introduced legume which is a close relative of the Kudzu of the South, promises to be outstanding in filling an important place in the need for forage and for the control of soil erosion in the Tropics. In cooperation with the Soil Conservation Service it has been shown that this legume is well adapted to many areas in Puerto Rico.

A rubber breeding garden containing most, if not all, of the known higher yielding clones has been established in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering, thus providing a permanent source of such plant material under the American flag. The assembly in one location of these high-yielding clones may make possible the development of still better varieties through cross-breeding.

Over 200,000 rooted plants were distributed to the military forces during World War II. In addition, large quantities of cuttings, seedlings, and grass sod were provided. These materials were used for camouflage, for improvement of new bases, for production of needed crops in new areas, and similar purposes.

Preliminary experimental work with 2-4-D has demonstrated that this herbicide has considerable value in the control of several important tropical weeds including cohitre and nut grass which are considered to be the worst weed pests in many tropical areas.

Control of Insect Pests and Diseases. The control of insect pests is a problem which affects practically every important tropical crop. Likewise the storage of seed and plant material under tropical conditions is a serious problem. A cheap and effective method of protecting seed corn ears from storage insects was developed by rolling the ears in hydrated lime as soon as the grains had separated. The use of 1 percent DDT emulsified with soybean oil and soybean flour did not give satisfactory control of the West Indian fruitfly in mangoes. The dipping of paper-wrapped baits of coconut, cornmeal, and beans poisoned with barium carbonate, in imitation olive oil, more than doubled the acceptance of such baits by rats.

In cooperation with the Bureau of Entomology and Plant Quarantine several shipments of sugarcane moth borer parasites were received from Brazil to aid in the control of this insect pest. The successful establishment of insect parasites and predators in Puerto Rico has resulted in their redistribution to the continental United States and to other countries.

A quarantine house for introduced plant material has been maintained by the station in cooperation with the Bureau of Entomology and Plant Quarantine. Several insect pests and plant diseases are known to have been prevented from becoming established in Puerto Rico through retention and treatment in quarantine. During the past year a considerable quantity of new varieties of sugar cane was held for observation prior to distribution to local growers.



Bamboo Production and Industrialization. Of the 40 species and varieties of bamboo introduced by the station, several are now being grown widely for industrial use. The manufacture of bamboo furniture was started two years ago. In recent months, a manufacturer of split bamboo fishing rods has set up a factory in Puerto Rico. A considerable quantity of bamboo has been sold through the local Puerto Rico Development Company to manufacturers on the continent this year. These new industrial developments have greatly stimulated interest in the growing of bamboo and over 10,000 culms were distributed to local farmers during the past year.

A considerable quantity of these better varieties of bamboo were shipped to Central and South America through cooperation with the Office of Foreign Agricultural Relations. The feasibility of using bamboo as a soil erosion crop was definitely established and is being recommended by the Soil Conservation Service.

Studies were completed on the life history of the bamboo powderpost beetle which causes West Indian bamboos to be useless for commercial or industrial purposes. Indications were obtained that moisture and specific gravity of the wood were minor elements influencing attack, apparently inoperative where starch was present. The number of species and varieties on which relative susceptibility tests have been made was brought to 11.

Cooperation with the Government of Puerto Rico. The Government of Puerto Rico has continued to support the work at the Federal Experiment Station by annual appropriations, thus making possible close and active cooperation in agricultural research of local importance. This program has been concerned particularly with such crops as vanilla, bay and other essential oil crops, and other tropical crops of local significance. Vanilla is a high value crop which offers promise in Puerto Rico and production has increased slowly but steadily over recent years. Studies on the conditioning and curing of vanilla have shown that a superior product can be obtained by conditioning vanilla at 45 degrees C. rather than at lower temperature. Likewise, the time of curing was reduced from 5 to 3 months by the former method.

The work on essential oils was concentrated largely on investigations of bay oil; a local industry of minor importance but one which might well be expanded. Large variations in oil content were found in samples of bay leaves collected at various locations. Selection and propagation of the more promising species were undertaken. An extensive experiment on the culture of bay, comparing fertilizer, mulching, and orchard practices, was undertaken. Results to date indicate the need and desirability of a breeding program.

Studies on the optimum height of harvesting citronella grass and lemon grass were continued and it was found that 4-1/2 feet and 2-1/2 feet respectively were the optimum under the conditions found at Mayaguez. The Java variety of lemon grass was found to be superior to the West Indian in the yield of grass and oil. In a study of the basal, middle, and upper portions of lemon grass, it was found that the percentage of oil was less in the lower parts. Intermittent distillation of lemon grass gave superior results to ordinary distillation.

As a result of the introductions made several years ago by the station, commercial plantings of Chinese ginger were made in several locations on the island during the past year. This crop promises to be a new high value crop for the small farmer.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations; 1946	Estimated obligations; 1947	Estimated obligations; 1948
<u>Special Research Fund, Department of</u>			
<u>Agriculture, Office of Experiment</u>			
<u>Stations: For administration of</u>			
<u>payments to States for research</u>			
<u>under Title I of the Bankhead-Jones</u>			
<u>Act of June 29, 1935.....</u>	\$23,977:	\$25,900:	\$25,900
<u>Working Fund, Agriculture, (Office</u>			
<u>of Experiment Stations)</u>			
<u>(Advance from Defense Supplies</u>			
<u>Corporation) Establishment of</u>			
<u>permanent source of high-yielding</u>			
<u>strains Cinchona seed in Hawaii</u>			
<u>and Puerto Rico .....</u>	4,184:	3,269:	- -
<u>Penalty Mail Costs, Department of</u>			
<u>Agriculture (Allotment to the</u>			
<u>Office of Experiment Stations):</u>			
<u>For cost of penalty mail pursuant</u>			
<u>to Section 2, Public Law 364, 78th</u>			
<u>Congress .....</u>	501:	630:	780
<u>TOTAL, OBLIGATIONS UNDER SUPPLEMEN-</u>			
<u>TAL FUNDS .....</u>	28,662:	29,799:	26,680

BUREAU OF ANIMAL INDUSTRY

(a) Animal Husbandry

Objective: Through research, (a) to develop means of improving the productivity, both in quantity and quality, of our domestic farm animals, including poultry; and (b) in cooperation with State authorities, to administer regulations for the improvement of poultry, poultry products, and hatcheries..

The Problem and its Significance: Livestock and poultry products vary greatly in quantity and quality per animal unit. Many losses occur which could be avoided by improved breeding, feeding, and management practices. Although the average productivity of the Nation's herds and flocks has increased many fold in the past half century, strains of animals and methods of feeding which outdo the present average in some cases by one and two hundred percent have been developed. The development of these strains of livestock and of these new principles of feeding repays many times over the cost of the research, but such research cannot be done by individual farmers and poultrymen as it is too time-consuming, too costly, and requires far too much pooling of trained talent.

General Plan: Investigations include (a) testing the merits of different systems of breeding; (b) developing strains possessing inherent characters for high level of performance; (c) studying the various management factors that tend to keep livestock healthy and reduce losses; (d) determining the fundamental nutritive requirements of livestock; (e) determining the best methods of using feeds to obtain maximum results in growth and reproduction; and (f) studying the effects of the foregoing and of processing upon the quality of meat, eggs, animal fibers, and other livestock products.

Receipts: During the fiscal year 1946, approximately \$133,000 from the sale of livestock and livestock products which had served their purpose for investigational work was deposited to the miscellaneous receipts fund of the Treasury.

Examples of Progress and Current Program: The following examples of recent accomplishments in various lines of livestock and poultry research will serve to illustrate the practical nature and direct usefulness of the work being conducted under this appropriation:

1. Swine husbandry investigations:

Cross-breeding for better performance: Efforts to produce better-performing strains of swine by crossing Danish Landrace and American breeds have met with such success that during the past year 27 boars from the different strains were placed in producers' herds to test their merit for the production of high-quality market hogs. With few exceptions the offspring of these boars are performing well in the feedlot and their high quality carcasses are receiving the approval of local butchers who handle them. These strains represent one step in the development of better-performing hogs for the American farmer. Further purification in the breeding for litter size, growth rate, and carcass quality will be sought by close breeding and selection.



Protein-mineral supplements: In tests of eight different combinations of protein-mineral supplements, with such feeds as tankage, fishmeal, distillers solubles, middlings, and liver meal, one containing 10 per cent each of tankage and fishmeal proved to be more efficient for general use for growing and fattening hogs in dry lot than other supplements containing 20 and 50 per cent of tankage. These tests demonstrate that a considerable saving in corn and other grains used in swine feedings could be effected if high-quality protein-mineral supplements were more generally used in swine feeding.

Cooked potato ensilage as feed: Feeding tests have shown that cooked potato ensilage is one method of salvaging a surplus of potatoes in periods of overproduction, for later use in swine feeding. The results indicate that temperatures of about 60° F. during the fermentation period are the most satisfactory for the economical preservation of potato ensilage for swine feeding.

Acute uremia in young pigs: A post-mortem examination of young pigs dying during the first nine days of life showed that acute uremia was responsible for a high percentage of deaths. Typical cases showed a considerable amount of orange-colored precipitate in the kidneys, ureters, and urinary bladder. Losses due to the above condition ranged from 21 to 45 per cent during different seasons. A similar condition was produced experimentally in young pigs by withholding food, thus indicating that the condition may be caused by faulty management of the sow during gestation or at farrowing time and her failure to come in milk soon after farrowing. Further study will be necessary to determine definitely the cause of uremia in young pigs and methods of prevention and cure.

## 2. Sheep and goat husbandry investigations:

Breeding of sheep for wool of specific types: At the United States Sheep Experiment Station, Dubois, Idaho, marked progress is being made in the breeding of sheep for wool of specific types. Columbia, Corriedale, and Targhee sheep that represent the prevailing types of whitefaced crossbred sheep on western ranges are being used in these experiments that are contributing to the standardization of sheep of the respective types for the production of wool of specific types.

Hormones used to stimulate production of earlier lambs: Great economic benefits would come from the production of normal breeding reactions in ewes at any season of the year. At Beltsville, Maryland, efforts are being made to produce such reactions with estrogenic hormones. At this stage of the experiment efforts are being made to determine the most efficient dosage and combination of hormones. This hormone research is aimed at the production of lambs in seasons earlier than the usual time of the year for ewes to lamb, because of the higher prices that are paid for early lambs that are finished to slaughter grades. The work thus far is fundamental to an understanding of the way in which hormones react on ewes.



Feeder lamb losses caused by urinary calculi: Efforts to control losses among feeder lambs that are caused by urinary calculi have led the Bureau into a study of wether lambs in a search for the factors in certain sorghum feeds that appear to cause the formation of urinary calculi. The results indicate the need for avoiding too much hard limestone dirnking water when feeding milo grain to lambs.

Grazing management: Studies in grazing management with sheep at the United States Sheep Experiment Station, Dubois, Idaho, conducted jointly by the Bureau and the Forest Service, show that where ranges are too heavily stocked with sheep the palatable perennial weeds and bunchgrasses are dying out. This results in lower production of usable forage. The results show that proper stocking is essential to maintain ranges of the sagebrush type in highly productive condition.

Crested wheat grass for reseeding: At the Bureau's Idaho station, crested wheat grass and several other species of grass are showing considerable promise for use in reseeding abandoned farm lands in that sheep-grazing region. These promising species have been used only to a very limited extent in reseeding work. For this reason large scale tests of them under range conditions are awaiting the development of an adequate seed supply. These results are leading the way to great economic improvement of the western ranges that are naturally well adapted to the production of sheep for abundant supplies of choice lamb meat and wool.

Selecting sheep for wool production: An effective method of selecting sheep for wool production has been developed at the Research Center at Beltsville, Maryland. Measurements of density, diameter, and length of staple of wool, and the weight and size of the bodies, were taken on Shropshire sheep at intervals until they were 52 weeks of age. Correlations between these measurements and the clean wool in the fleeces of these sheep were highly significant. It was found that by weighing weanling lambs, measuring the length of staple in their fleeces, and estimating the density of their fleeces, it is possible to predict the relative weight of clean wool per fleece that may be expected from these lambs when they come to shearing age. In this way the most profitable wool producers can be selected when they are weanling lambs.

Mouton fur is being made from lambskins and they offer sheep producers an appportunity for additional income from another profitable use of sheep products. At Beltsville, the Bureau is now investigating the factors in wool and skin tissue that are associated with the desired qualities of mouton fur. Results show that some Merino lambskins make choice mouton fur, but that several of them are inferior due to extra thick leather and big rib marks on the fur caused by an excess of skin folds or wrinkles on the lambs producing such skins. These studies are pointing the way to effective selection of sheep and lambs for this profitable and popular mouton fur product.

### 3. Horse and mule husbandry investigations:

Improvement of Morgan horses: The rapid growth of public interest in the use of light horses as a popular means of recreation in recent years, and particularly during the last two or three, has broadened materially the practical application and usefulness of the Bureau's light horse investigations with Morgans at the U. S. Morgan Horse Farm, Middlebury, Vt. In this work, the old type Morgan has successfully been improved in both size and quality through the application of linebreeding and improved methods of selection. Members of the stud today are not only considerably taller and heavier on the average than their predecessors, but such increases have been attained without any sacrifice of quality. Continued efforts to improve the general riding qualities of Morgans are also resulting in the production of individuals having better performance at the walk, trot, and canter and the popularity of the improved type has been spreading rapidly to other sections of the country beyond the traditional New England stronghold of this breed, particularly to the Middle West and the Pacific Coast areas.

Minimum roughage levels for pregnancy and growth studied: Results of studies on the minimum bulk suitable for horses have shown that it is possible to maintain adult horses or ponies, either idle or, at work, on rations which supply roughage at a level as low as one-fifth of that customarily used. As the roughage level has been reduced the efficiency of utilization of concentrate feed has increased. A study to determine whether minimum roughage levels suited to maintenance and work are adequate for pregnancy and growth has now been in progress for approximately 2 years. It appears from results thus far obtained that the requirements for the successful completion of pregnancy are probably greater than for maintenance and work. Foals carried to term by mares on low roughage rations have been strong, healthy animals which have grown out at greater rate than in the case of two control animals on the usual roughage levels. Although in localities where roughages are produced there is greater economy in the utilization of large amounts of roughage, in those areas such as are found around large cities along the eastern seaboard bulky feeds are sometimes expensive beyond their real value.

### 4. & 5. Beef and dual-purpose cattle husbandry investigations:

General: The breeding work with beef and dual-purpose cattle has been designed to measure the breeding ability of cattle through the performance of offspring handled under a standard procedure. The Department of Agriculture, in some instances in cooperation with State agricultural experiment stations, has taken the lead in developing methods for measuring performance in beef and dual-purpose cattle. Records of performance of offspring offer a means of locating breeding animals that are capable of transmitting to a high degree those characteristics most desired in beef or dual-purpose cattle, such as efficient feed utilization, high fertility, high rate of gain, and high quality of product.

In the past, show-ring standards have been used by most of the breeders of purebred cattle as the yardstick for measuring the worth of a breeding animal. This method has been responsible for the use of many breeding cattle that have had their faults and defects buried underneath an abundance of fat. Breeding projects have clearly shown that the only dependable method of selecting a desirable breeding animal is one based on the performance of the offspring, and not on the appearance. Our investigations show that from 20 to 30 per cent more weight at the yearling age can be produced by selection on the basis of performance; that growth ability is inherited and may be measured at various ages; that birth weight is indicative of growth ability and that growth rate after weaning is highly controlled by the heredity that an animal receives from its parents.

As an illustration of progress which has been made, there may be cited the increase in growth rate of beef Shorthorn steers and the increased yield of milk in dual-purpose Shorthorn cows in the herds at the Agricultural Research Center. A beef Shorthorn sire, bred and proved at Beltsville, Maryland, sired progeny which, as steers, attained an average slaughter weight of 900 pounds in 428 days. The average for all steers tested was 480 days to reach 900 pounds, a saving of considerable value to the commercial beef producer. In the dual-purpose herd two generations of selection for beef and milk simultaneously resulted in decreasing the time required by the steers to reach 900 pounds weight by 61 days and increased the milk production of the heifers on first lactation by 1150 pounds.

Ability of calves to gain in feed lot highly heritable: Studies on heritability of rate of gain of beef cattle were continued during the year at the U. S. Range Livestock Experiment Station, Miles City, Mont., in cooperation with the Montana Agricultural Experiment Station. The studies were based on the gains of 422 steers from 43 different sires, fed for a period of 252 days. An analysis of the hereditary and environmental relationships between growth rates indicated that the genetic influences of the sires for rate of gain for the entire 252-day period was about 85 percent heritable in their progeny. Heredity thus plays a most important part in determining the gains of calves in the feed lot. Based on this conclusion, the progeny testing of calves for gaining ability may prove unnecessary and selections for this ability can possibly be made through comparative feeding tests of the prospective herd sires. However, carcass qualities must necessarily still be measured through slaughter tests of the progeny.

Crossbreeding Brahman and native cattle: Experiments in which crossbred types of Aberdeen-Angus x Brahman cattle are being developed at the Iberia Livestock Experiment Farm, Jeanerette, Louisiana, indicate that each of three types possessing  $1/4$ ,  $3/8$ , and  $1/2$  Brahman blood shows greater adaptability to the region than purebred Aberdeen-Angus, as measured by growth and mature weight of the cattle and by calf production. The halfbred cows have produced the heaviest calves at weaning and these calves have developed into cows that have maintained a slight weight advantage up to about 4 years, and they have had the highest overall calf production.



Vitamin A deficiencies in steer rations preventable: In experiments with fattening steer calves at Beltsville, vitamin A deficiency developed when an otherwise balanced ration which contained 11 to 14 pounds of yellow corn plus oat-straw roughage was consumed. These steers showed the symptoms characteristic of vitamin A deficiency, such as blindness, convulsions, stiffness, edema (anasarea), and rapid breathing in hot weather, which in extreme cases terminated in death. It was found that the addition of carotene (provitamin A) in the form of alfalfa meal to the deficient ration of the steers corrected the deficiency satisfactorily, and the symptoms disappeared if the ration was corrected in time. If sufficient carotene is included in the ration at the beginning and continued through the feeding period, deficiency symptoms will not develop.

These experiments have shown that fattening steers should have a daily allowance of at least 1.35 milligrams of carotene per 100 pounds of body weight. Since yellow corn cannot be depended on to furnish this amount of carotene, well-cured, high-quality hay or silage must be added in order to insure an ample supply of provitamin A.

Calf crops in south Texas: Experiments in South Texas in a 20-inch rainfall belt, have over a 7-year period shown marked advantage in percentage calf crops, weights of calves at a weaning age of 8 months, and in the condition of the mother cows as a result of phosphorus supplementation of native range in that area.

These experiments indicate that when phosphorus-deficient ranges are supplemented with phosphorus, the pounds of weaned calf produced annually per section of range area can be increased from 20 to 80 per cent depending upon the type of supplementation used. It is estimated that the tonnage of beef can be increased in the phosphorus-deficient areas of the Gulf Coast country alone by more than 20,000,000 pounds per year by marketing the steer calves at from 8 to 10 months of age.

Effect of grazing on tree reproduction: During the past year the third test to study the effect of cattle grazing on tree reproduction following logging, and the effect of logging and degree of use on grazing capacity was conducted in cooperation with the Forest Service and the Bureau of Plant Industry, Soils, and Agricultural Engineering of the Department, and the State Agricultural Experiment Station and State Department of Agriculture of North Carolina. Eight pastures of 48 acres each were used which were composed of duplicate comparisons. Four of the pastures were logged in 1942-43 but the trees in the other four were uncut. There was very little difference in the rates of cattle gain between the logged and unlogged pastures, but the cattle in the heaviest rate of stocking made the smallest gains and their pastures were the closest grazed at the close of the season. Grazing observations revealed no evidence of pines (which are the type of reforestation desired in that area) being browsed. There are vast areas of timberland in the Coastal Plain of North Carolina and in similar regions of the adjoining States. A high percentage of this forest region has been cut

over, and the likelihood is that most of the rest of it will be cut over before many years. Indications are that this land will furnish valuable forage for beef cattle without seriously affecting natural reforestation. The land owner can in this way be receiving some revenue from his forest lands while he waits for his timber to grow back to optimum stage for cutting and at the same time reduce the fire hazard.

Feeding cottonseed cake in late summer increases steer gains: In July, August, and September the average protein content of all range grasses grazed in tests at the Southern Great Plains Experiment Station at Woodward, Oklahoma, amounted to 5.4 per cent, which is greatly below the minimum required for rapid growth and fattening of beef cattle. Consequently, yearling steers on grass alone made a four-year average daily gain of 1.41 pounds per head during this period, as compared with 2.24 pounds for the first three months of the summer when the average protein content of the grasses was 13.0 per cent. During the last half of the summer grazing season of 1945, the feeding of cottonseed cake in sufficient quantity to overcome the protein deficiency in the range grasses resulted in maintaining gains at rates almost as high as those recorded on more nutritious grass alone during the first three months. The increased gains resulting from feeding rations of 1 and 2 pounds of cottonseed cake to each steer in late summer were in approximate proportion to the amounts of supplement fed. The additional weight gains of 50 pounds per steer for those fed 1 pound of cake and 70 pounds for those fed 2 pounds, and their greater finish and higher market value, left a substantial profit after defraying the cost of buying and feeding the concentrate. The results of these tests have application to the greater part of the Great Plains region, which represents the greatest beef production area in the United States.

#### 6. Poultry husbandry investigations:

Inbreeding: Investigations at the Agricultural Research Center at Beltsville, Maryland, have demonstrated that chickens can be inbred successfully and hybrids obtained that produce at least 2 dozen more eggs per bird per year than standard-breds kept under similar conditions. The standard-breds in these comparative tests average 200 eggs annually. Further research to develop inbred lines and testing for the production of superior 2-way, 3-way, and 4-way hybrids is needed in order to obtain sound practical information of use to poultry breeders, hatcherymen, and producers. The results of cross-breeding, the development and use of inbreds, and the production of hybrids are being made available to the public through popular and technical publications as well as lectures. Carefully controlled tests in the future will be made to compare the crossbred progeny of parental stock of proved performance, with the hybrids. The cross of two standard-breds of proved quality is much more easily produced than the hybrids.

Improvement in poultry meat: In experiments to improve the meat quality of chickens, especially in broilers, several strains of Dark Cornish fowl and New Hampshires were studied. The Dark Cornish has an extremely

wide breast and produces an ideal meat carcass. However, this breed usually has low egg production, grows slowly, and hatches poorly, and thus its use for commercial production is economically unsound.

The New Hampshire, while economically sound from a production standpoint, has an unsatisfactory breast at broiler age. One of the Dark Cornish strains studied gave good performance in general. The hatchability was fair, and the chickens were fast feathering and rapid growing. It is planned to further improve this Dark Cornish strain and to make some crosses between this broadbreasted chicken and the much more popular but mediocre breasted New Hampshire. Selections for the best qualities in each breed will be followed on a family basis with a view to developing a strain or breed that can be used for the production of quality broilers.

Improvement of egg quality by selection and breeding methods has been demonstrated for percent of thick white, increased shell strength, relative freedom from blood spots, and ability to maintain the original quality of the egg even when subjected to temperatures of 100° F. for several days. Technical and popular articles have been published stressing the application of these results to field methods used by poultry breeders. Additional research is needed to determine the mode of inheritance involved in each of these egg-quality characteristics so that more exact information can be given to assist poultry breeders in producing strains of chickens that will lay eggs of better quality. Results already attained will greatly benefit the consumer and increase the consumption of eggs.

Golden Leghorns: A new variety of chicken, the Golden Leghorn, has been produced at the Agricultural Research Center and will soon be available to State colleges and experiment stations for field tests. These Leghorns have all the commercial characteristics of the White Leghorns, and their plumage color makes it possible to identify the sexes. Poultrymen now lack varieties of chickens laying white-shelled eggs that can be used in crosses to produce an economically sound white-egg crossbred. Further research is necessary to improve shell color and egg weight. Tests are needed to determine the efficiency of this new variety when crossed with other white egg varieties such as the Black Minorca, Black Leghorn, Mottled Ancona, etc.

The Beltsville Small White turkey produced at the Agricultural Research Center is being bred under commercial conditions in almost every State. The unusual fecundity, hatchability, and size of this strain make it especially suitable for commercial production and family use. Because of the consumer demand for a small, well-fleshed turkey, these birds usually command a premium price. Research is being continued to further improve the efficiency of these turkeys in the production of hatching eggs and meat. Many descendants have been produced from two 200-egg non-broody turkeys and a high producing, non-broody line of turkeys is being developed.

Utilization of vegetable protein supplements: Among problems in poultry nutrition, the one concerned with the utilization of vegetable protein supplements has been given the greatest attention. Not only during the war, but also in the pre-war years, the quantity and quality of poultry feeds were limited by supplies of protein supplements more



than by any other one factor. It has been estimated that during the 1941-42 feed year (October 1, 1941 to September 30, 1942) poultry consumed 2,452,000 tons of commercial high protein concentrates and that an additional 1,419,000 tons of these materials would have been required for the most efficient nutrition of the poultry population. The most likely sources of the additional protein needed to overcome this deficit appear to be soybean meal, cottonseed meal, peanut meal, and other plant protein concentrates. In the past, however, these materials have been considered nutritionally inferior to the animal protein supplements.

Experiments at the Agricultural Research Center during the past year have demonstrated the existence of a previously unknown dietary factor present in animal protein supplements of high quality. Diets consisting of soybean meal, grains, alfalfa meal, and mineral and vitamin supplements, plus this new factor, are just as good from the standpoint of growth of chicks and hatchability of eggs as are diets containing animal proteins. The unknown factor has been found to be relatively abundant in the feces of cows and of hens regardless of the diet fed. Concentrates have been prepared from cow manure which were effective when fed to chicks as 0.004% of the diet, indicating that the unknown factor, like the known vitamins, is potent in very small quantities. This factor is an effective supplement not only to good commercial soybean meal but also to meal that has been inadequately heated in processing. It seems likely therefore that abundant supplies of this factor might permit considerably greater economy in the processing of soybeans.

Fiber in the diet: In experiments on the efficiency of different diets for egg production, it was demonstrated that fiber in the diet decreases the efficiency of laying hens to a greater extent than has been suspected. A diet containing 5.9% fiber, a level very commonly fed, was less efficient than one containing only 2.6%. The fiber was supplied by oats, wheat millfeeds, and alfalfa meal. This subject should be investigated further so that in the evaluation of these feedstuffs this undesirable effect can be balanced properly against their known desirable characteristics.

Characteristics of poultry meat: The important characteristics of poultry meat have been investigated. Variations in the nicotinic acid content were studied because this vitamin (the antipellagra vitamin) is probably the most important contribution of poultry meat to the human diet, and variations in fat content were studied because of the importance of the fat in determining flavor and eating quality. It was found that the nicotinic acid content of poultry meat is to some extent dependent on the nicotinic acid content of the feed and that it decreases slightly as birds increase in age from 6 to 18 weeks. In spite of these variations, however, no qualification needs to be added to the statement that the light meat of poultry ranks with the best sources of nicotinic acid in the human diet and that the dark meat is a very good source, being on the same level with beef and pork muscle. In studies of the fat content of poultry meat it was found possible to increase the fat associated with the leg and breast muscles by increasing the fat content of the diet during the last two weeks before killing. The hardness and color of the fat deposited were very greatly influenced by the type of fat in the diet.

The National Poultry Improvement Plan, which was placed into operation July 1, 1935, has now been voluntarily adopted by 47 of the States. This plan establishes standards for the production of hatching eggs and chicks with respect to breeding improvement and freedom from pullorum disease.

Industry participation in the plan reached a new peak during the fiscal year 1946 and consisted of 3,951 hatcheries, 90,000 hatchery supply flocks, and 23 million birds. The egg capacity operated by the participating hatcheries represented about half the total hatchery capacity in the United States.

Four hundred and sixty-nine flocks are now being trapnested under ROP (record-of-performance) supervision in 45 States. The number of candidates under supervision increased from 173,183 last year to 209,301 this year; the number of single-male matings increased from 3,757 last year to 4,190 this year; and the number of females in single-male matings increased from 53,081 last year to 61,849 this year.

Very satisfactory progress has been made in the control of pullorum disease. The average percentage of reactors in the first test has decreased from 3.7% in the four million birds officially tested in 1935-36 to less than 2% in the twenty-three million birds tested in 1945-46. The adoption of a low tolerance class, U. S. Pullorum-Controlled, has contributed a great deal to the progress of pullorum disease control. The number of hatcheries qualifying for this class increased from 971 last year to 1505 this year.

Breeding improvement and pullorum disease control work with turkeys in 39 States is now conducted officially by the State agency administering the National Poultry Improvement Plan in each of those States in cooperation with the Bureau. About 5,000 flocks containing approximately 3,000,000 breeding birds were officially tested for pullorum disease. The incidence of pullorum reactors among these birds was less than 1.5%. Pedigree breeding under official supervision in the U. S. Record of Performance and U. S. Register of Merit stages of the plan include 240 matings in the flocks of 34 breeders. Improvement in hatchability, egg production, and uniformity will be accelerated through use of pedigreed males from families of officially established superiority in these characters in hatchery supply flocks.

The following table showing participation for the fiscal years 1936, 1941 and 1946 illustrates the rapid growth of the work:

National Poultry Improvement Plan

Item	Extent of participation during year ending 6/30		
	1936	1941	1946
States .....	34	44	47
Hatcheries .....	1,017	2,465	3,952
Egg capacity of hatcheries .....	38,066,000	117,915,752	259,452,943
Breeding flocks .....	23,813	59,136	92,324
Breeding birds .....	3,522,409	12,010,766	24,903,635
Breeding birds tested for pullorum disease .....	2,053,159	10,527,946	24,903,635
Average percentage of reactors first test..	3.66	2.86	1.84
U.S.R.O.P. (U.S. Record of Performance) flock owners .....	1/	335	345
U.S.R.O.P. flocks .....	190	445	471
Birds entered in trap-nest flocks .....	66,547	154,969	210,708
U.S.R.O.P. breeding pens:	1/	2,749	4,212
Females in U.S.R.O.P. breeding pens .....	8,207	38,957	62,255

1/ Complete information not available

8. Fur resources investigations:

Fur farming in the United States is a relatively new enterprise compared with other branches of the livestock industry. Knowledge of the nutritive requirements, details of breeding, and the best management practices, is incomplete. Research on the important production problems has been scattered and relatively small in volume. Practically no work has been done on breeding for improved fertility, vigor, and the quality of animal products. Intensive research needs to be conducted to determine the nutritive requirements of the different species for growth, reproduction, and yield of high quality fur. The recent decrease in supplies of horse meat has resulted in a critical situation, making it necessary to develop satisfactory substitutes of this important constituent in the diets of mink and foxes. Without adequate nutritive elements in the diet, growth rate is slow, viability is poor, reproduction is difficult, and fur quality is inferior.



Investigations are now under way dealing with the problems of breeding, nutrition, management, and the technology of the products of fur animals raised in captivity, including rabbits. Research is being conducted at experiment stations at Saratoga Springs, N. Y., Fontana, California, and Petersburg, Alaska, and cooperative research is being conducted at the Washington Agricultural Experiment Station, Pullman, Washington, and at Swarthmore College, Swarthmore, Pa. Research on the microscopic characters of fur fibers and design to recognize the factors contributing to fur quality is being conducted at the National Agricultural Research Center at Beltsville, Maryland.

(b) Diseases of animals.

Objective: (a) to obtain information leading to measures for the control of the infectious and non-infectious diseases of domestic animals, including poultry, which are of particular importance at the present time; and (b) to develop practical methods of coping with the numerous parasites that produce stunting, unthriftiness, and deaths in livestock and poultry.

The Problem and its Significance: The losses to the livestock industry from diseases and parasites total millions of dollars annually. Many animal diseases and parasites are also communicable to man and are a menace to public health. Since the organization of the Bureau of Animal Industry, research work on the cause, mode of transmission, and measures for the control of infectious and parasitic diseases, has been one of its major efforts.

To control diseases and parasites it is necessary to have certain fundamental information on the causative agents, how they are propagated, and how disease is produced and spread from one animal to another. When adequate information on these points is available efforts can then be directed to the development of measures whereby losses from a particular disease can be reduced, or the disease even eradicated. These efforts may include studies on sanitary measures, vaccination procedures, and the use of therapeutic agents. As a result of such research, great strides have been made in the control of many animal diseases and parasites in the United States through concerted efforts of Federal and State agencies. However, many problems are continually arising in disease control programs which need further investigation. Advances are constantly being made in methods of research, and new drugs are being developed for the treatment of diseases. Continued research on animal disease problems is essential to improvement of existing methods for their control and eradication. Moreover, new diseases are reported from time to time, and investigations are necessary to identify them and to develop methods for their control. Heavy losses are produced through poisoning of stock by plants, and considerable losses are caused also by non-infectious diseases. Full information is not at hand on many of the diseases affecting the nation's livestock and poultry.

General Plan: Investigations are made into methods of diagnosis, cause, mode of transmission, and methods of prevention, treatment, and control of the more important infectious and non-infectious diseases of livestock including poultry. These investigations embrace field and laboratory activities. Studies of the diseases as they exist in the field are made, and bacteriological, serological, pathological, immunological, and animal inoculation studies are conducted in the laboratory.

To develop a practical and scientific basis for eradication or controlling parasites, (1) studies are conducted on the distribution of these pests in the major agricultural regions of the United States, taking into consideration climate, soil types, pastures, and topography; (2) methods are developed for accurate diagnoses; (3) the infective

states are investigated with a view to developing methods for their destruction; (4) the mode of transmission is determined by experiments in the laboratory and observations in the field; (5) the injuries produced and symptoms exhibited by experimentally-infected animals are noted in order to develop sound methods for field diagnosis; (6) the immunological responses, if any, are investigated as aids in control; (7) weak links at which the vicious cycles of parasites may be broken are explored; (8) intermediate hosts are investigated and methods are devised for their eradication and control; (9) field tests to develop promising control measures are conducted on a small scale under conditions that enable the investigators to determine the factors that might be involved; and, finally (10) the most promising control measures are tested in the field in cooperation with farmers and stockmen, and control measures are adapted to meet varying conditions existing in different parts of the country.

To meet the ever-pressing need for affording infected animals prompt relief from the drain of parasitic infestations and saving the lives of young animals that have but little resistance to cope with mass attacks by parasites, experiments are conducted with drugs and chemicals to determine effective and inexpensive methods of destroying external parasites on, and removing internal parasites from, livestock and poultry. Investigations are conducted also to develop practical methods of destroying the infective stages of parasites in the manure, which is the most fertile source of parasitic infestation on the farm and range.

#### Examples of progress and current activities:

##### 1. Investigations of brucellosis (contagious abortion) of livestock:

Brucellosis of cattle: Probably the most effective weapon developed in the control of brucellosis is Strain 19 *Brucella abortus*, an organism of reduced virulence, developed by the Bureau, which is used in the preparation of a vaccine. Its fame is widespread throughout the world through its ability to increase the resistance of non-infected animals vaccinated with it. It does not cause the disease in vaccinated animals but will prevent infection in approximately 80 per cent of animals so treated, and abortion in about 95 per cent. Unfortunately, the blood reaction following vaccination cannot be differentiated from actual infection, except in calves where the blood titer disappears within a few months. Moreover, one injection does not cause lifelong immunity. The work of the Bureau during the past few years in this connection has been to determine the persistence of vaccinal blood titers in vaccinated animals and the persistence and degree of immunity established, to develop methods by which the best results may be obtained with this vaccine, and to coordinate the use of the vaccine with other methods of control. Much more information is required to determine the optimal amount of vaccine required and the best methods for injection of this material.

During the past year it was proved in Bureau research that a practical immunity will persist for a period of 4 to 5 pregnancies when the vaccine is properly applied. Field results indicate that between the 4th and



6th years following vaccination there is a tendency for the immunity to decrease appreciably. It would appear very urgent, therefore, that revaccination should be studied in a long range experiment to determine the optimal period for the second injection of the vaccine or possibly a third injection, the increased resistance or immunity developed as the result of the second injection, and other data incident thereto. Work on the intradermic method of injection of the vaccine, in which 1/25th of a subcutaneous dose is administered, has been in progress during the past two years and the results so far indicate that it results in an immunity quite comparable with that produced by the subcutaneous injection. Animals vaccinated intradermically must be followed several more years, however, before the persistence of immunity induced can be determined. If this research should show that the intradermic method is as effective as the subcutaneous method, it will result in a marked decrease in the cost of vaccination to the livestock owner.

Strain 19 vaccine as a cure: Some practicing veterinarians are of the opinion that Strain 19 vaccine injected into known reactors has a tendency to cure the disease. Previous work has not shown such a statement to be true. In the past year additional information was secured through the vaccination of 22 reacting heifers ranging in age from two to three years. These infected animals were vaccinated with Strain 19 and followed through the subsequent gestation period. It was found that this treatment did not prevent abortion in affected animals nor a recession of the blood titers. As a result of this work a more definite statement can now be made of the inadvisability of expenditure of time and money in the vaccination of animals already infected.

Vaccinated animals exposed to disease: During the past year a long-term experiment was concluded in which groups of vaccinated animals with unvaccinated controls were held until their 4th and 5th pregnancies before being exposed to virulent Brucella abortus. In these experiments 86 per cent of the vaccinated animals resisted an exposure that caused active infection and abortion in all control animals.

An actively infected herd of cattle is maintained at Beltsville, Maryland, wherein alternate calves born in this environment are vaccinated. Research in this herd has disclosed the efficacy of vaccination in protecting against herd exposure.

Brucellosis of swine: This is not so widespread as the similar disease in cattle, but is becoming more so as the result of herd improvement through the purchase of pedigreed swine. This disease is of economic importance to the owner in that whole litters are aborted. These abortions may occur so early in pregnancy that many times they are overlooked and the animal thought to be sterile. When brucellosis breaks out in a previously normal herd, a large majority of the sows abort, thus creating an almost total production loss to the owner. Although the disease tends towards self-limitation in an individual animal in a period of approximately 6 to 18 months, in some the infection persists for indefinite periods, thus providing continual exposure to young stock.

This disease is much more infective for man than the similar disease of cattle and thus it is much more of a public health hazard than the latter. Cattle at times may contract the swine type of infection where the species commingle, and the organism Brucella suis may become established in the udder of cattle and be given off in the milk. This was shown in an outbreak of 79 cases of brucellosis in persons who consumed raw milk from a dairy in Iowa. The swine type of organism was found in these affected persons and subsequently recovered from the udders of several cattle in the dairy herd.

Work is being carried on at the present time with a diagnostic skin test which gives promise of improved detection of infected animals. Much experimental work along this line must be done to establish the accuracy of the skin test. Vaccination of hogs with Strain 19 vaccine has been found to produce a slight increase in resistance but not sufficient to be of practical value. Further work is planned with a swine strain of low virulence similar to Strain 19 Brucella abortus and with vaccines produced from virulent strains irradiated by ultra-violet light. Research by the Bureau during the past year has indicated that the organism Brucella suis is expelled from the body of the infected animal in the urine, thus contaminating the surroundings.

Bovine and swine brucellosis compared: Owing to the many differences between swine brucellosis and bovine brucellosis, identical methods of control cannot be established. A majority of the work following the initial academic research has been along the lines of the development of practical control measures. First suggestions in this connection were that the entire herd should be eliminated, the premises cleaned and disinfected, and a fresh start made with uninfected stock. As a result of work by the Bureau and two cooperators, it would appear that a practical method of control can be established through the segregation of young pigs, following weaning from the older infected herd and the continued testing of the young stock up to breeding age. Complete separation of the two herds must be made. A number of herds have apparently been freed of infection by this procedure. At the present time no cure has been established for this disease.

Brucellosis of goats: Goats are affected by a germ which causes a disease quite similar to that of brucellosis in cattle and swine. The germ is undoubtedly the most infectious of the three Brucella germs for man. This has been established on the Island of Malta and other Mediterranean sections where the disease is widespread, with resulting extensive infection in human beings who drink the milk of infected goats.

Research has been applied to the development of improved diagnostic methods. In this connection it has been necessary to study infection, both natural and artificially produced, in order to determine where the organism localizes, the persistence of infection, and the nature of the agglutinin response following infection. Unfortunately our present diagnostic test does not detect all infected goats and for this reason research must be continued in the hope of establishing a test that will be more accurate in the diagnosis of this disease.

2. Investigations of infectious diseases of livestock and poultry caused by bacteria and fungi, other than brucellosis:

Tuberculin and johnin: In studies carried out during the past year and directed towards improving the specificities of tuberculin and johnin for detection of tuberculosis and Johne's disease, about 300 products were prepared, subjected to comparative tests for specificity, and the results subjected to statistical analyses. So far, a definite increase in specificity has occurred in only one type of product--residues retained when tuberculin is passed through a 5% ultrafilter. If further confirmed, these results will show that specific and non-specific factors are present in tuberculin, that they can be separated, and that more specific tuberculins and johnins are a definite possibility. Improvement is also needed in technique which will permit the detection of infected cattle that occasionally do not react to tuberculin even though definitely diseased. Herds containing such animals are difficult to bring to a disease-free status. Tuberculin and johnin have in the past been injected into the caudal fold. However, recent research has indicated that certain other areas may be more sensitive to these diagnostics than the caudal fold. Studies are being made of these problem herds in order to determine whether injection in more sensitive areas may permit detection of infected cattle which otherwise would not be detected.

Survey of Johne's disease: Preliminary to making a survey of the incidence and distribution of Johne's disease in the United States, a survey was completed in one county of Alabama and surveys are in progress in two other counties. These surveys are expected to permit an evaluation of the importance of Johne's disease and should also furnish some information regarding difficulties encountered in tuberculin testing.

Mastitis: The seriousness of infectious mastitis of cattle, from the standpoint of public economy as well as that of the individual herd owner will be appreciated from the fact that 30 to 35 per cent of our dairy cattle are affected with this disease and that each infected cow represents a 25 per cent decrease in its milk production. Control methods combining sanitary practices and chemotherapy have been evolved and are being perfected. Unfortunately, no simple procedure is available at the present time because extensive laboratory tests must be made primarily of milk from each quarter of each animal in the herd to determine the number of quarters carrying infective organisms, a treatment of the proper kind instituted and retests of milk samples from the treated quarters made at various intervals subsequently to determine whether or not the infection has been eliminated or further treatment advisable.

Swine erysipelas still competes with hog cholera for first place among the diseases that constantly threaten the economic stability of swine breeders of this country. Serum-live culture vaccination has apparently met with splendid results since inception of the cooperative project



to study this method of active immunization early in 1938. Since inception of the work to January 1, 1946, 98,205 herds comprising 6,646,630 head of swine have been vaccinated. Erysipelas developed in 811 herds (0.8%) subsequent to vaccination, in 9,567 swine or 0.14% of the total number vaccinated. Surveys of non-vaccinated herds of the same area showed an increased herd incidence of erysipelas from 38% in 1938 to 67% in 1942. The use of virulent live culture, however, is not the most satisfactory answer to the problem of prevention and control of this disease. It is potentially dangerous to swine, turkeys, and man. Numerous cases of erysipeloid have developed in man as a result of accidental inoculation with the culture. It is planned to develop and test attenuated and killed agents for the prevention of swine erysipelas. A strain of the organism has been obtained which it is hoped will prevent the disease at less cost to the swine owner, with no danger of spreading the disease, and with all danger to the operator eliminated.

The action of the salts of penicillin on swine erysipelas has been studied and is found to be effective as a treatment for the disease in small laboratory animals and turkeys, if sufficiently large doses are administered over a period of several days. The necessity of repeated administration eliminates it as an economical method of treating the disease at farm level. It is our intention to test new drugs and antibiotics as they become available for this work.

Anthrax: Since 1915 outbreaks of anthrax have been reported from at least 43 States, including 438 counties. The five States that have not reported outbreaks are Arizona, Indiana, Maine, Michigan, and West Virginia. During the past decade one or more widespread outbreaks of a virulent nature occurred in South Dakota, Nebraska, Mississippi, Louisiana, Texas, and California, while sharp outbreaks of a less severe nature have occurred in Arkansas, Alabama, New Mexico, and Nevada. Numerous sporadic outbreaks in other States have occurred. Since 1937 there has been a steady decline in outbreaks in the mid-west anthrax area of South Dakota, Nebraska, Minnesota, and Iowa due largely to annual preseasonal vaccination. A complete report of these studies titled "History and Distribution of Anthrax in Livestock in the United States," was published in the October 1945 issue of Veterinary Medicine.

Fowl typhoid: A recent nationwide survey by questionnaire directed to State animal health authorities concerning the prevalence of and losses due to fowl typhoid yielded the following information. There were 980 outbreaks in 34 States reported. The survey showed that the disease is most prevalent in States along the South Atlantic seaboard where there was an average of 86 outbreaks of fowl typhoid during the past year, while in the remaining 31 States reporting there was an average of 7 outbreaks. Eighteen of 45 States reported an increase in fowl typhoid outbreaks during the past five years. In the Delmarva peninsula area, where the broiler raising industry has reached its greatest concentration, there were nearly 400 outbreaks during the past year resulting in the loss of thousands of broilers and breeding birds alike.

In cooperative field experiments a new method of control of fowl typhoid in breeding flocks has been carried out, consisting of repeated rapid-whole-blood agglutination tests at monthly intervals, and the removal of all reactors, however slight, until no more reactors are found. In a large breeding establishment of 70,000 layers where losses during the preceding 3 or 4 years had been so heavy from fowl typhoid that they were unable to replace them even by year-around raising of breeding stock, the incidence of fowl typhoid has been cut to zero for the current year as a result of this control procedure. This method of control is advocated as a result of research work showing that the apparently healthy carrier bird is by far the greatest factor in the spread and perpetuation of fowl typhoid in a flock from year to year. Research, including flock treatments in the field, has shown that vaccines and treatments with the sulfonamide drugs are relatively ineffective in controlling outbreaks of fowl typhoid.

3. Investigations of infectious diseases of livestock and poultry caused by viruses:

Sleeping sickness of horses: During the last 15 years more than a million horses and mules and thousands of people have been attacked by the mosquito-borne virus that causes equine encephalomyelitis, or sleeping sickness of horses. The Bureau's annual report on the distribution and incidence of the disease for the calendar year 1945 records less infection than for many years, although a serious epidemic occurred in people in parts of rural California. With favorable weather, major outbreaks are a constant threat, despite the fact that there is available a highly effective preventive vaccine. Tests made during the year failed to reveal any new foci of the two different native types of the virus. Constant vigilance in this regard is advisable, however, not only for recognition of changes in conditions with respect to native types of the infection but also in order to detect any possible introduction of other distinct virus forms that have occurred in various foreign countries. A cooperative project covering identification of virus types encountered in the field has been proposed to the Bureau by one of the State experiment stations. This desirable project is receiving consideration.

Hog-cholera: Although hog cholera, the most important disease of swine, can be prevented by treatment with serum and virus, that method of prevention offers no possibility of eventual eradication. Eradication is not possible because the virus used in the treatment is the causative agent of the disease, and serum-virus treated pigs are possible sources of infection for a time following treatment. However, a product developed by the Bureau, crystal-violet vaccine, although preventing the disease, is incapable of producing the disease, and thus may permit eventual eradication. Although crystal-violet vaccine has been released for commercial production, there are unsolved problems regarding its preparation and value under different conditions which need further study. Probably the most important is the need of improving the potency of the vaccines.

The duration of immunity conferred by crystal-violet vaccine was studied in experiments which involved vaccinating a large group of pigs and then exposing a few of the group from time to time to hog-cholera virus. So far, all pigs exposed up to 406 days following vaccination have been found to be immune. Experiments were made to determine the effects of age on the potencies of vaccines. A vaccine was used when fresh and it protected pigs for one year. The same vaccine afforded immunity of equal duration when it was used at the age of one year. The results therefore indicate that crystal-violet vaccines retain for a year their ability to protect at least one year.

Infectious anemia of equines is a virus disease, transmissible by flies, which has appeared in at least 29 States. It occasions heavy losses both by death and greatly reduced condition. In Europe, it has been reported as affecting man. It has been shown that the virus can persist in the blood of a horse for more than 11 years, that lyophilized (quick freezing and drying) blood of the carrier animal retains its virulence for at least 32 months, that filtered serum containing virus loses its virulence after 42 months storage in the refrigerator at 40°-50°F., that red blood cells from an acute case are still capable of causing the disease even after being washed six times in saline solution, laked by distilled water, and finally subjected to rapid freezing and thawing repeated six times, a procedure which thus could not be used for producing vaccine.

Blood from two human patients suffering from a form of anemia suggestive of equine anemia was tested on horses and found not to contain the equine virus. Interest by Public Health workers in the relation of some human anemias to equine anemia was responsible for carrying out these tests. Penicillin in large doses was not found effective against the disease. Recent studies have shown that the blood serum from known carriers of the virus have the property of agglutinating the red blood cells of horses. Further investigation of this phenomenon as a possible diagnostic test are under way.

Newcastle disease, one of the most serious virus diseases of poultry, has caused extremely high mortality in at least 16 foreign countries during the past 20 years. A milder, but potentially just as serious form of the disease already has been identified in about 20 States in this country during the last two years. The extent of the infection in the United States is not known at present. Although the death losses from the malady have been much less than those experienced in foreign countries, the disease must be rated as serious because of its highly infectious nature, its growth-retarding effect, and its influence in decreasing egg production, in some cases to the zero point, lasting for several weeks or longer. No less important is the fact that there is no assurance that the disease will not assume the highly fatal form exhibited in other countries where the infection has occurred.

The Bureau has maintained a supply of antiserum and representative domestic strains of the virus which are necessary for purposes of diagnosis. Clinical symptoms cannot be relied upon solely for identification of the disease; laboratory facilities are essential for



exact diagnosis of the infection. Only a few of the State laboratories are equipped for this work, and demands upon the Bureau have been very heavy. As an aid to establishment of the needed diagnostic facilities an outline of diagnostic procedures and equipment has been prepared for general distribution. Many primary and confirmatory diagnoses have been accomplished. Assistance in training diagnosticians is being planned presently.

Through cooperation with the School of Medicine, Duke University, basic studies of purification of the virus, and its characters have been carried out.

Tests of commercially produced anti-Newcastle disease vaccine have been made. The results indicate that birds under two weeks of age do not develop appreciable immunity following vaccination. Older birds responded definitely, but antibodies returned to a low level within four months. The vaccine, as now constituted, produced objectionable residual lesions at the point of injection, which would preclude practical use of the vaccine in broilers or other birds destined for food in as short a time as two months after vaccination.

Additional facilities, such as isolation units, are essential for complete tests of the vaccine now available, and attempts at improvements of the product. These are now being provided in the Washington laboratories. Plans and specifications for the building at Beltsville for research on Newcastle disease which is to be constructed with funds provided in the 1947 appropriation are now nearing completion.

Studies to determine whether the disease is egg-transmitted are urgently needed. These will be undertaken as soon as the facilities mentioned above are available.

#### 4. Investigations of non-infectious diseases of livestock and poultry:

Poison plants: Poisoning by plants is still a serious problem, particularly in the range country. At the Salina, Utah, Experiment Station, feeding tests of a recently introduced plant, *Halogeton glomeratus* (no common name), caused death of animals when fed 1.5 per cent of their body weight of the green plant. Alfalfa hay was found to have considerable protective value when given animals eating the plant. In the Southwest, tansy mustard is fairly good forage except at flowering stage. When fed dry it was found to cause no losses. Tests with 2,4-d, the new weed killer, have shown that forage sprayed with this substance is still palatable for animals and without toxic effects. The fatal dose of 2, 4-d for sheep was found to be 50 times the amount a sheep would consume in a day while grazing sprayed forage. The results thus far obtained on the destruction of poisonous plants by 2, 4-d have not been entirely satisfactory and further tests will be made.

Necrotic enteritis is a swine disease which ranks close to hog cholera and swine erysipelas as a cause of loss among young pigs. While long supposed to be the result of infection with *S. choleraesuis*, there has been in recent years considerable evidence that this or a similar disease may be associated with faulty diet, and attention has been focused in this connection on nicotinic acid deficiency. The role of nicotinic acid in this disease has been under study for several years. Working with purified diets, convincing evidence has been obtained that most pigs require nicotinic acid for normal growth, and that nicotinic acid deficiency is frequently accompanied by intestinal lesions resembling those of necrotic enteritis, as judged by the normal growth and condition of pigs receiving the same diet with nicotinic acid added. During the past year evidence has been obtained to indicate that when 40 to 70 per cent of corn is incorporated in a similar purified diet the deficiency effects are accentuated, whereas pigs receiving the same diet with nicotinic acid added thrive and remain normal. There is a suggestion that the corn may exert an anti-nicotinic acid effect.

5. Investigations of protozoan parasites of livestock and poultry, including coccidiosis:

Anaplasmosis now ranks as a cattle disease of major importance. It has already occurred in 27 States and appears to be spreading. The mortality is usually high, and in recovered cases convalescence is slow, the animals becoming carriers of the infection in their blood for years and probably for life. No drugs or biological products have been found capable of clearing the blood of the infection, and it seems probable that eradication of the disease will depend on detecting and removing all carrier animals.

During the year encouraging results have been obtained in developing a serological test (complement fixation) for detecting carriers. An antigen has been developed by using a modification of the methods employed for preparing a similar agent in the test for human malaria. Many samples of serum from cattle in the experimental herd, as well as from animals on the farm, have been subjected to the test. In general the results have been very promising. The chief obstacle in the test yet to be overcome is the factor introduced by behavior of serum from certain cattle, known as anticomplementary action. Modifications of the present technics are underway and should eventually eliminate this hindrance. Experiments with the antigen used in this test have shown that it is incapable of causing the disease and has some immunizing value. A vaccine prepared from the spleen of an infected animal has also shown considerable vaccinal potency. Further work along this line is underway.

An analysis of data from 50 cases of experimentally produced anaplasmosis was made to determine the constants and variables during the course of the disease. This was done to determine criteria for evaluating the efficacy of drugs used in experimental treatment of anaplasmosis. The study revealed that although the course of the disease is variable, the period of patent rise in infection (that stage during which the anaplasma infection of the red blood cells is building up) is reasonably constant. This observation suggests that this period of patent rise of infection should be selected as the stage of the disease during which experimental testing of drugs should be undertaken, since the data show that visible symptoms ordinarily occur at, or after, the peak of infection has been reached.

Bovine trichomoniasis investigations were continued in cooperation with owners of beef and dairy herds. The results confirm previous reports that the disease--a venereal disease caused by a protozoan parasite having an affinity for the reproductive system--can be eliminated in a herd if:

- (1) All infected bulls, as determined by breeding records and/or demonstration of the causative organism (Trichomonas foetus) in prepuce, are withdrawn from service.
- (2) Non-pregnant and presumably unexposed females are artificially inseminated with semen from a known uninfected bull.
- (3) When all females that calved normally are rested for at least 90 days before being served by an uninfected bull.

Observations over the past three years have demonstrated the practicability of this program. Although no specific, effective treatment for infective bulls to eliminate the infection has been perfected, considerable progress has been made in this direction. So far 6 out of 10 infected bulls have been cured of their infection by a course of treatment with iodine compounds, and these results show that many infected bulls, representing valuable blood lines, may be restored to profitable service in the herd.

6. Investigations of worm parasites of livestock and poultry, such as tapeworms, flukes, and roundworms:

Lamb scours:

In view of the situation prevailing on the Northern Plains where lamb scours are very costly to sheep raisers, experiments, involving 16 lambs, were carried out to ascertain whether superimposing an infection of small trichostrongyles or bankrupt worms upon an existing infection of the common stomach worm, would produce diarrhea, such as frequently occurs in range lambs harboring parasitic infections of similar magnitude.



Worm parasites of swine: Previous work done in the Bureau showed that pigs kept in contaminated lots can be protected from acquiring intestinal roundworms, nodular worms, and whipworms, by feeding to them skim milk or whey daily, or at regular intervals. Pigs so fed were not only free, or nearly so, of such parasites but made far more satisfactory weight gains than others kept in the same or similar lots. The latter pigs harbored a more or less heavy load of the parasites mentioned. In further experiments during the fiscal year 1946 the conclusion was that freedom from parasites rather than the feeding of skim milk was responsible for the satisfactory weight gains of the pigs involved in the experiment.

Tests were carried out to ascertain whether water suspensions of powdered skim milk and powdered buttermilk when fed in lieu of grain to pigs kept on contaminated soil would prevent acquisition of parasites and promote more adequate weight gains than a grain diet. Pigs fed powdered skim milk or buttermilk daily made average daily weight gains of 1.20 pounds, and remained either entirely free of worms or the infections were minimal; pigs fed reconstituted milk at intervals of two weeks made average daily weight gains of 0.85 pounds, and either remained free of worms or were only infected lightly; and the control groups, those fed only grain, made an average daily weight gain of 0.46 pounds and, in general, became heavily infected with worms.

While this test showed that it is possible to use powdered skim milk or buttermilk suspended in water as a means of minimizing parasite infections of pigs kept on contaminated ground, another test showed that powdered skim milk and buttermilk are inferior to fluid skim milk in promoting satisfactory weight gains.

Liver flukes: Studies of liver flukes on pastures indicate that the Gulf Coast Region of Texas there is a period during the late summer and fall when flukey pastures are free of the infection. Moreover, the period when the pastures are free of viable metacercariae is sufficiently long to enable the young flukes in the host animal to reach maturity before the snail intermediate hosts are forced out of estivation in the soil by the fall rains and reinfect the pastures. Therefore, in the region mentioned treatment of cattle with hexachlorethane in the late fall before the onset of rainy weather will destroy the majority of the flukes and fewer eggs will be passed by the infected animals onto the pastures during the season when the snails are most active, thus reducing materially the chances of cattle acquiring heavy fluke infections.

7. Investigations of miscellaneous parasites of livestock and poultry:

The Index-Catalogue of Medical and Veterinary Zoology was maintained, as in previous years. It is used extensively by various governmental agencies, as well as those of foreign countries, as a source of information on parasites and parasitic diseases. Publication of the catalogue, which was suspended in 1942 and resumed during the fiscal year 1945, is progressing; page proof of five parts of the Author catalogue, H to L, has been read during the year, and other parts M to Q, have been submitted for publication.

The research collection of parasites, maintained in cooperation with the U. S. National Museum, has been augmented by the acquisition of a large private collection amounting to approximately 8,000 lots of specimens. The collection, which is extremely valuable in connection with the identification of parasites of domestic animals and those of wild animals that may be transmitted to domestic livestock and poultry, now includes more than 40,000 lots of parasites.

8. Investigations of treatments for parasites of livestock and poultry:

Cattle-grub control: Last year a brief account was given of the initiation near Colorado Springs, Colorado, of a test program on cattle-grub control on an area basis. In the fiscal year 1946 a relatively large number of the cattle, representing a cross section of those treated the previous year, were examined to determine the reduction in the grub population. In two large herds, located centrally within the area, the average reduction was approximately 85 per cent. In herds located near the border of the area, and therefore subject to attacks by heel flies from adjoining areas, where cattle were not treated, the reduction was less striking. However, the overall reduction of grubs in the cattle of the entire area was 70 per cent. During the fiscal year 1946 the original area was reduced by 56 square miles on its eastern border because one cooperator, having 1,235 cattle withdrew from the project. The area was extended, however, by 50 square miles to the north, thereby taking in 30 new cooperators with a total of 1,018 head of cattle. During this year, 2,248 cattle were treated with the standard rotenone-containing wash. Approximately one-half of the cattle were treated for the first time, and one-half for the second consecutive year.

Spinose ear tick: A number of tests were made to develop a more effective treatment than has heretofore been available for the destruction of the spinose ear tick. The work was done on small farm herds in the Rio Grande Valley. The cattle used in these tests had access nightly to old corrals where they were exposed to almost continuous reinfestation. Moreover, the cattle selected for treatment harbored such large numbers of larval and nymphal ticks that their ears were tightly packed with these parasites. Treatment with the standard pine tar-cottonseed oil preparation, and with a 0.25 per cent DDT preparation, afforded protection from reinfestation for only a few days. However, treatment with a preparation containing benzene hexachloride not only killed the ticks in the ears rapidly, but also afforded considerable protection against reinfestation.

9. Fur resources investigations:

Diseases and parasites still take a large death toll of fur animals and contribute heavily to lowering the vitality and the quality of the animals which survive. Carefully conducted research on the basic biological problems involved in all these factors is urgently needed if fur farmers are to receive the assistance requested to improve the efficiency of their farming operations.

The non-parasitic diseases which presently cause the greatest losses to the fur and rabbit industries are infectious virus diseases, particularly distemper and encephalitis in foxes and mink, and such bacterial diseases as snuffles or pasteurellosis in rabbits, as well as paratyphoid infections in all species. Much basic information on the nature of the causative agents, their artificial propagation and adaptation to vaccinal purposes, as well as modes of spread of the infections is needed before adequate control measures can be assured.

Many factors in connection with the acquisition and effects of internal parasites including roundworms, hookworms, and lungworms in foxes and mink, and coccidia in rabbits, upon their hosts are not thoroughly understood. Basic facts must be ascertained before satisfactory and practical control measures or remedial treatments can be developed.



(c) Eradicating tuberculosis and Bang's disease

Objective: To eradicate tuberculosis in livestock (including poultry), paratuberculosis in cattle, and Bang's disease (brucellosis or contagious abortion) in cattle, and to provide partial compensation to owners of cattle condemned and destroyed because of being affected with the diseases.

The Problem and its Significance: Tuberculosis is one of the most serious diseases of cattle, swine, and poultry, because of its effect in reducing production and causing a considerable loss of meat condemned as unfit for food. It is also a menace to the public health, as it may be transmitted to children using unpasteurized milk and dairy products from infected cows, causing tuberculosis of the glands and bones. Much has been done in eliminating bone tuberculosis, which frequently manifests itself in humans as hunchback, by the eradication of tuberculosis in cattle. Notwithstanding the great progress made in stamping out this disease, it is reliably estimated that an annual loss of \$10,000 can be attributed to it, \$5,500,000 of which is borne by the poultry industry, \$2,000,000 by the swine industry, and \$2,500,000 by the cattle industry. In swine it may progress to a point where it becomes generalized, but in most of the carcasses showing evidence of the disease on post-mortem examination, only slight lesions are found. Avian (fowl) tuberculosis is particularly difficult to eradicate because of the fact that the organisms are so resistant and live for many months in the soil.

Bang's disease is found among cattle in practically all sections of the United States, although the degree of infection is much greater in some localities than in others. In those sections where there has been a considerable exchange of cattle, a high degree of infection is found. This condition also obtains in and around the large milk-shed areas. It is conservatively estimated that this disease is responsible for an annual loss of \$30,000,000 to our livestock industry. Approximately 75 percent of all breeding trouble in cattle is caused by this disease, the principal effects of which are (1) abortion or premature birth of calf; (2) reduction in the production of milk; (3) retention of fetal membranes, with very serious results; (4) sterility or failure to breed successfully; and (5) predisposition of newly-born calves to other serious diseases, especially such diseases as scours and pneumonia, and at times, mastitis.

In recent years it has been proved that undulant fever in man is caused by the same germ that causes Bang's disease in cattle. A considerable number of such cases have been reported which resulted from the ingestion of Bang's disease germs in raw milk. Handling pork products coming from animals infected with Bang's disease is also a means of transmitting undulant fever to man.

General Plan--Cooperation with States: Eradication work is conducted in cooperation with livestock sanitary officials of the various States, and is governed by State laws and regulations. Tuberculosis eradication is carried on under the test-and-slaughter plan, but cooperating States may elect one or more of the three plans for Bang's disease eradication: (a) test-and-slaughter plan; (b) test-and-slaughter with calfhood vaccination; and (c) test-and-retention of reactors, with calfhood and adult vaccination.

Under the test-and-slaughter plan, tests are applied to the cattle by veterinarians employed by the Bureau, states and counties, and by practicing accredited veterinarians, to detect the existence of any infection in the living animal. Reactors are appraised at their market value, taking into consideration their quality as breeding and dairy animals, after which they are slaughtered under supervision. In addition to their salvage value, the owner receives from the Federal Government one-third of the difference between the appraised value and the salvage, not to exceed \$25 for grade animals and \$50 for registered purebred animals. Federal payment is further limited to an amount not exceeding that paid by the cooperating state, county, and municipality. Payment from all sources, including the salvage, cannot exceed the appraised value of the animal.

Under the test-and-slaughter with calfhood vaccination plan, all cattle over 6 months are usually tested. The vaccination of animals is confined to calves between 4 to 8 months of age, 6 months being the preferable age. The age and date of vaccination of each animal is properly recorded, and the identity of each animal definitely established. Animals in herds in which vaccination is practiced are not to be disposed of, except for immediate slaughter, without written permission of the cooperating state or Bureau officials. A herd under the vaccinal plan may be certified as a "herd Free of Brucellosis" for a period of 1 year when all animals in the herd over 2 years of age reveal at least 2 negative reactions to official blood agglutination tests, properly spaced, and the vaccinated animals under 2 years of age show a satisfactory blood titer. The payment of Federal indemnity for adult cattle in such herds that react to the test depends upon the circumstances in the individual states.

Under the test-and-retention of reactors, with calfhood and adult vaccination plan, the owners of herds practicing calfhood vaccination are permitted to hold reactor cattle under strict quarantine until they can be replaced by healthy animals. The milk from such animals is, of course, properly pasteurized. No Federal payment will be made for these reactors at any future date.

Supervision is maintained over the disposition of all reactors which have been consigned to public stockyards for slaughter, and over the testing at such stockyards of cattle to be shipped interstate for dairy or breeding purposes.

In combating avian tuberculosis, the veterinarians employed in the field cooperate with the local livestock sanitary officials and the owners of poultry flocks. Cooperation is also obtained from certain local organizations and owners of hatcheries.

Examples of Progress and Current Program:

1. Eradicating tuberculosis in livestock (including poultry): When the cooperative campaign for the control and eradication of tuberculosis in livestock was undertaken in 1917 by the livestock sanitary officials of the various States and this Bureau, in cooperation with the livestock owners and other interested agencies, it was estimated that approximately 5 per cent of all the cattle in the United States were affected. In some localities, however, the infection was much greater than in others. Through the fiscal year 1943, very satisfactory progress was made, the percentage of infection having been gradually reduced to 0.18. However, during the fiscal year 1944 it rose to 0.2 per cent, with a further increase to 0.24 per cent in 1945. This was during the period when many of the Bureau's veterinarians were in the military service. In the fiscal year 1946 the percentage of infection was 0.23, a slight reduction. Many veterinarians returned to service during the year.

All counties in every State, Puerto Rico, and the Virgin Islands continued to be in the modified accredited area, signifying that tuberculosis in cattle has been reduced to less than one-half of 1 per cent.

Swine tuberculosis: That cattle affected with tuberculosis can transmit the disease to swine has been proved by numerous experiments and the recovery of the bovine tubercle bacilli in such animals. During the fiscal year 1946, of the 42,670,242 swine slaughtered at official establishments operating under Federal meat inspection, 3,245,746 carcasses, or 7.6 per cent, showed some evidence of tuberculosis and were retained for further inspection. This is a slight increase over the 7.2 per cent reported for the previous fiscal year. On each hog retained, excluding those that were later sterilized or condemned, there was an average loss of a minimum of 65 cents at current wholesale values, or a total waste of pork and pork products amounting to approximately \$2,100,000. Adding the loss under State and city inspection, it would approximate \$4,000,000. Of those retained for further inspection, 10,514 entire carcasses, representing more than 1,100,000 pounds of pork, were condemned as unfit for food. An additional 8,725 carcasses, or about 91,000 pounds of pork, were passed for sterilization. Just 10 years ago, of a total slaughter of approximately 28,506,000 swine under Federal supervision, 2,925,593, or 10.3 per cent, were retained for further inspection as showing some evidence of tuberculosis. Of that number, 31,584 entire carcasses were either condemned or sterilized. It is interesting to note that although over 16,000,000 more hogs were slaughtered under Federal supervision in 1946 than in 1936, more than 12,000 fewer carcasses were condemned or sterilized.



Avian tuberculosis: State, county, and Federal veterinarians engaged in the tuberculin testing of cattle in sections of the country where avian tuberculosis exists make observations of poultry flocks for the purpose of locating any infection. During the fiscal year 1946, these employees observed approximately 51,200 flocks, containing about 8,065,000 fowls, located in 10 States. In addition, about 10 veterinarians employed by the Bureau devoted their entire time to this work. Such men, working with organizations interested in the poultry industry, State livestock sanitary officials, and local veterinarians, visited 4,442 farms and inspected 691,529 fowls. Infection was reported on 340 premises. These employees also applied the tuberculin test to 226,291 fowls, disclosing 4,900, or 2.1 per cent, reactors, which is a slight decrease over the 2.8 per cent infection reported during the previous year.

Johne's disease (paratuberculosis) eradication work was continued during the year. While this disease is not widespread, it does exist to a slight extent among cattle in many States, and it is quite difficult to control. During the fiscal year 1946, 13,195 cattle were tested, of which 150, or 1.1 per cent, reacted. This is a considerable decrease over the 6.2 per cent infection reported during the previous year.

Indemnity payments to cattle owners are made, in cooperation with States and counties, as an aid in maintaining healthy herds and replacing diseased cattle with clean stock. During the past 10 years the average appraisal of condemned animals has increased approximately \$100, the average salvage approximately \$40, and the average State payment approximately \$25, while there has been an increase of only \$1.44 in the average Federal payment. Cooperation from the various States in providing funds for this work has been excellent. During the fiscal year 1946 the States provided approximately \$4,100,000, of which about \$1,350,000 was for indemnity and \$2,750,000 for operating expenses. For the fiscal year 1947 approximately \$4,400,000 has been provided by the cooperating agencies, of which about \$1,400,000 is available for indemnities and \$3,000,000 for operating expenses.

STATEMENT OF COMPARATIVE TESTING, HERDS AND CATTLE UNDER SUPERVISION, MODIFIED ACCREDITED AREAS,  
AVERAGE APPRAISAL, SALVAGE, AND STATE AND FEDERAL INDEMNITY IN TUBERCULOSIS ERADICATION WORK

FISCAL YEARS 1935 TO 1946, INCLUSIVE

Fiscal Year	Tests Conducted		Reactors found	Per- cent infection	Under Supervision		*Modi- fied accred- ited areas	Average during year		
	Herds	Cattle			Herds	Cattle		Apprai- sal	Salvage	State Indem- nity
1935	2,378,668	25,237,532	376,623	1.5	6,590,863	48,768,627	2,428	\$57.55	\$15.19	\$15.87
1936	1,944,624	22,918,038	165,496	.7	6,515,273	59,907,935	2,921	77.66	28.50	10.18
1937	961,109	13,750,308	94,104	.7	6,745,471	61,640,711	3,030	86.04	28.94	12.20
1938	1,007,586	14,108,871	89,359	.6	6,471,538	62,640,358	3,124	86.76	32.16	16.41
1939	750,806	11,186,805	60,338	.5	6,372,720	60,439,030	3,142	89.01	34.49	18.96
1940	819,408	12,222,316	56,343	.46	6,191,330	61,570,426	3,148	91.05	37.12	20.44
1941	777,435	12,229,499	40,702	.3	6,235,198	62,696,167	3,151	96.50	40.99	20.95
1942	681,504	10,983,086	28,008	.26	6,320,006	63,073,213	3,151	109.69	50.35	21.49
1943	563,413	9,308,936	17,167	.18	6,317,670	63,846,496	3,151	135.19	65.03	27.50
1944	524,927	8,894,466	18,338	.2	6,153,069	64,519,652	3,151	154.53	59.93	36.07
1945	484,749	8,105,480	19,534	.24	6,120,528	64,790,921	3,151	161.32	59.78	40.51
1946	505,296	8,454,463	19,464	.23	6,035,783	65,981,089	3,150**	174.58	68.60	37.27

\*Includes Puerto Rico and the Virgin Islands

\*\*Two counties consolidated





## 2. Eradicating Bang's disease (brucellosis) in cattle:

Efforts to control and eradicate brucellosis of cattle (also called Bang's disease or infectious abortion) were taken up 12 years ago by the Federal Government in cooperation with the State livestock sanitary officials and cattle owners. At that time cattle values were extremely low and provision was made for the payment of Federal indemnity for reactors condemned and slaughtered without requiring any payment on the part of the cooperating States. Such plan was followed until May 1939, when Congress made the requirement that the Federal payment could not exceed the amount paid by the cooperating State or other agency.

When the work was begun, the incidence of the disease was very high in many localities, the average for the entire country being estimated at 10 per cent. Through the fiscal year 1941 there was a gradual reduction in the percentage of infection disclosed as the result of official testing, the incidence of infection having been reduced to the low figure of 2.4 per cent. Since that time, however, there has been a gradual increase, and during the fiscal year 1946 the percentage of infection had risen to 5.0, just about double what it was 5 years ago.

The increase in the number of cases of undulant fever in humans has stimulated the demand for the testing of cattle in many areas where unpasteurized milk and dairy products are used. Surveys indicate that it is much more prevalent than is generally appreciated. Of more than 7,000 school children tested in one group, 9 per cent were found to have the disease. Among children who came from families that kept their own cows, the rate jumped to 18 per cent.

Practically all the States have plans for accrediting individual herds as free from Bang's disease. At the close of the fiscal year 1946, there were approximately 44,000 such herds, containing about 840,000 cattle. Approximately 2,360,000 herds, containing about 17,870,000 cattle, were under official supervision for the eradication of the disease. At the close of the fiscal year, 527 counties, located in 22 States were listed as modified accredited areas and not more than 5 per cent of the herds showed any infection whatever on the last complete test. These 527 counties represent approximately 17 per cent of the total counties in the United States, and contain approximately 4,670,000 dairy and breeding cattle over 6 months of age. Approximately 175 additional counties are conducting area work looking towards eventual modification.

North Carolina continues the only State whose entire area has qualified as modified accredited, although 6 States have more than 25 counties in that classification. In several States, all the counties that have not been accredited are working toward that status.

The program of calfhood vaccination with strain 19 of the Brucella organism was greatly expanded during the past year. As Bang's disease is primarily a disease of breeding cattle, losses can be reduced to a minimum with reasonable certainty by the use of vaccine in conjunction with sanitary precautions and good herd management. More and more farmers have come to realize its value in building up resistance against the disease in their breeding animals, and the work is in considerable demand in practically all sections of the country. This work is conducted under official supervision in practically every State.

During the fiscal year 1946, Brucella vaccine was administered to 694,139 calves between the ages of 4 and 8 months, which is an increase of about 193,000 over the number vaccinated during the previous year. Since the program was inaugurated in 1941, a total of 1,966,130 calves have been vaccinated as a preventive against Bang's disease. Of the 245,786 reactors disclosed during the fiscal year 1946, 74,922 were retained under strict quarantine in herds practicing calfhoo

d vaccination. When they have outlived their usefulness as dairy or breeding animals and the vaccinated calves come of age, such reactors are slaughtered without the payment of Federal indemnity. The milk from such animals is, of course, properly pasteurized.

The administration of Brucella vaccine under official supervision to breeding animals over 8 months of age was conducted in 32 States with varying degrees of success. This practice was limited mostly to herds where the eradication of the disease by the usual test-and-slaughter method has been difficult, or to herds in which incipient infection was detected. As there is no way of distinguishing between a vaccination reaction and a reaction caused by brucellosis, adult vaccination interferes with the eradication of the disease by the test-and-slaughter method, and precludes the shipment of such animals to many States.

The testing of vaccine used in this work by technicians of the Bureau at Beltsville, Md., was continued. During the fiscal year 1946, samples of 3,229 batches of commercially produced vaccine were tested, of which 197, or 6.1 per cent, were found unsatisfactory and ordered destroyed. Some of the vaccine used in official work is prepared by the Bureau, as well as all the antigen used in official Bang's disease testing.

Indemnity payments to cattle owners are made to assist in the purchase of necessary replacements and establish and maintain healthy herds. While the average appraisal has increased approximately \$80.00, the average salvage, \$40.00, and the average State payment \$1.50, the average Federal payment has decreased \$7.52. During the fiscal year 1946, State and county appropriations for this work amount to approximately \$5,950,000, of which about \$3,325,000 was

for indemnity and \$2,625,000 for operating expenses. For the present fiscal year approximately \$5,000,000 has been provided by the cooperating agencies for indemnity and operating expenses. Only 6 States failed to provide indemnity funds for the fiscal year 1947, although 5 of those made varying sums available for operating expenses. The attached table shows, by years, the average State and Federal indemnity payments and other data pertaining to the progress of the work.



(d) Inspection and Quarantine

Objective: (a) The control and eradication of hog cholera and related swine diseases, cattle tick fever, scabies of cattle and sheep, dourine of horses, and the investigation of outbreaks of various other animal diseases; (b) the control of interstate shipments of livestock to prevent the spread of diseases; (c) the administration of the 28-hour law to prevent cruelty to animals in interstate shipment; (d) the administration of regulations governing the importation of livestock, animal byproducts, hay, straw, meats, etc., to prevent the introduction of diseases into this country, as well as regulations governing exportations of livestock and their safe transportation on vessels; and (e) the administration of regulations governing the certification for free entry of purebred livestock imported for breeding purposes by United States citizens.

The Problem and its Significance: Scabies, hog cholera and the other diseases covered by this item are readily disseminated and their control or eradication is important for the protection of the livestock industry.

Shipments of livestock which are affected with a communicable disease may cause other animals to become infected and thus cause severe loss to livestock owners. The discovery at public stockyards of shipments of livestock affected with communicable diseases prevents the further spread of disease and permits the infection to be traced back to its source.

It is important to safeguard the livestock industry against serious losses by preventing the introduction of destructive communicable diseases from other countries through the importation of livestock or through the medium of infected or contaminated animal byproducts, hay, straw, etc. In order to protect and promote foreign trade it is necessary to prevent the exportation of any animals affected with or that have been exposed to any communicable disease and to provide for the safe transportation of those animals which may be exported.

Through enforcement of the 28-hour law, animals in interstate transportation receive humane treatment, arrive at destination in better condition, and have a lower death rate while in transit. Shrinkage in weight is also reduced, resulting in a corresponding saving in the meat products produced from the livestock.

General Plan--Cooperation with States: Disease control and eradication work is carried on in cooperation with the States involved. In public stockyards work, an inspection force is maintained at principal market centers to prevent the dissemination of livestock diseases by detecting, segregating, and supervising the appropriate treatment or other disposal of animals affected with or exposed to contagious, infectious or communicable disease, and supervising the treatment and disinfection

STATEMENT OF COMPARATIVE TESTING, HERDS AND CATTLE UNDER SUPERVISION, AVERAGE APPRAISAL, SALVAGE,  
AND STATE AND FEDERAL INDEMNITY IN RANG'S DISEASE ERADICATION WORK

FISCAL YEARS 1935 TO 1946, INCLUSIVE

Fiscal Year	Tests conducted		reactors found	Per-cent infection	Under supervision		Averages during year			
	Herds	Cattle			herds	Cattle	Appraisal	Salvage	State indemnity	Federal indemnity
1935	212,482	3,317,760	381,010	11.5	187,109	2,936,347	\$ 56.86	\$19.87	1/\$27.99	\$24.29
1936	470,788	6,674,709	457,104	6.8	449,644	5,780,418	70.65	27.44	2/ 20.57	26.86
1937	630,917	8,021,167	397,864	5.0	719,452	7,877,612	70.67	27.94	3/ 19.25	26.45
1938	671,310	7,837,443	324,532	4.1	1,035,454	9,447,137	80.37	32.07	4/ 20.36	26.69
1939	724,613	7,591,398	219,165	2.9	1,372,410	11,111,643	97.17	33.97	5/ 26.09	20.00
1940	590,393	6,937,428	171,953	2.5	1,615,755	12,315,329	90.85	34.99	6/ 17.12	14.96
1941	677,544	7,465,254	182,075	2.4	1,883,914	13,932,693	93.23	37.68	7/ 17.19	15.19
1942	591,835	6,891,219	209,238 <sup>a</sup>	3.0	2,105,294	15,637,027	99.19	52.06	8/ 17.71	15.83
1943	392,636	5,185,228	197,329 <sup>b</sup>	3.8	2,199,535	16,616,582	128.03	64.87	9/ 18.63	16.77
1944	386,266	5,235,912	226,079 <sup>c</sup>	4.3	2,254,235	17,326,136	143.34	59.75	9/ 22.54	19.30
1945	395,236	5,213,458	243,050 <sup>d</sup>	4.7	2,307,585	17,545,638	139.36	56.63	9/ 22.14	19.25
1946	389,814	4,876,866	245,786 <sup>e</sup>	5.0	2,360,699	17,870,154	149.65	68.64	9/ 22.07	19.34
1/	State indemnity paid in 1 State		"	"	2/ State indemnity paid in 2 States		"	"		
3/	" " " 5 States		"	"	4/ " " " 10 States		"	"		
5/	Beginning May 1, 1939, Federal indemnity payment limited to not to exceed total amount paid by cooperating State agencies. State indemnity paid in 28 States									
6/	Indemnities paid in 36 States									
8/	" " " 41 States									
a	Includes 39,596 reactors held in calfhood vaccinated herds for which Federal indemnity will not be paid									
b	"	53,558	"	"	"	"	"	"	"	"
c	"	75,439	"	"	"	"	"	"	"	"
d	"	86,738	"	"	"	"	"	"	"	"
e	"	74,922	"	"	"	"	"	"	"	"

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of all cars, trucks, and other conveyances used in the transportation of infected animals, and all pens, chutes and alleys in which such animals are handled. In the import work under this item inspectors are assigned to stations along the international boundaries and on the seacoast to inspect animals, and when necessary to place them in quarantine, and to inspect animal byproducts, hay, straw, etc. In export work, animals are inspected and tested at ports and in the various districts of origin throughout the country.

With respect to the 28-hour law, records of the railroads are examined in certain localities to find violations. Such violations are then reported to Washington where they are analyzed. The railroads are notified of the apparent violation and invited to present any additional information if they think there was an excusable reason for the violation. Then the cases are prepared and sent to the Department of Justice for handling through the Courts. When time permits feeding stations are inspected to see that they are adequate and railroad representatives are contacted to find ways of preventing future violations. It is the desire of the Department to reduce violations to a minimum rather than allow conditions to exist which will bring an ever-increasing number of violations.

(Continued on next page)

Examples of Progress and Current Program:

1. Scabies eradication

Sheep scabies: During the fiscal year 1946 inspection and supervised dippings of sheep in the field totaled 24,399,605 and 295,738, respectively. Infection was found in 683 flocks (539 in Louisiana, the remainder in a few of the mid-western farm States) which is 57 more than found last year. Satisfactory progress has been made in all the co-operating states.

Cattle scabies: Cattle scabies eradication work was continued with 1,603,739 inspections in the field and 86,791 dippings supervised. A few cases of reinfection were found, showing the need for continued vigilance to guard against the spread of undiscovered infection. The Bureau also assisted in handling a few cases of sarcoptic mange in widely separated States.

2. Control over interstate shipment of livestock for the purpose of preventing the spread of communicable diseases

Diseased livestock detected: During the fiscal year 1946 inspection forces at public stockyards detected 150 diseased lots of cattle, sheep, and swine, involving 6,044 animals, exclusive of animals which reacted to the test for tuberculosis or brucellosis. These forces are making every effort to prevent the spread of livestock diseases by the prompt detection of animals affected with communicable diseases, and immediately treating the animals, premises, and transporting vehicles in a manner which will minimize the danger of spreading the infection. They also furnish information to the State livestock sanitary officials which aids them in locating and eradicating the disease at point of origin. The recent outbreak of foot-and-mouth disease in Mexico presents a greatly increased need for vigilance to prevent any repetition of any disastrous spread of the disease should it gain entrance into this country.

Cooperation with War Department and UNRRA: During the year the Bureau continued to cooperate with the War Department in protecting the health of its horses and mules by assigning experienced employees to supervise the cleaning and disinfection of cars and other vehicles and stockyard pens and equipment used in the handling of War Department animals. They also cooperated with the Production and Marketing Administration in the inspection of 20,446 horses for communicable diseases and conformation which were purchased for the account of UNRRA. This work also included the supervision of the cleaning and disinfection of the cars used in the transportation of these animals from concentration yards to ports of embarkation.

Shipments by motor truck: The heavy increasing use of the motor truck in the transportation of livestock has materially increased the work of inspecting such shipments because of the many small lots that have to be handled and identified.

Volume of work during the fiscal year 1946 is reflected in the following tables:

Inspection at public stockyards

	<u>1944</u>	<u>1945</u>	<u>1946</u>
Number of stockyards operating .....	48	45	44
Located in cities .....	46	43	42
Animals inspected:			
Cattle .....	23,412,083	26,587,725	25,175,626
Sheep .....	29,150,427	27,686,313	24,815,619
Swine .....	45,152,111	28,274,940	23,700,587
Total animals inspected ....	97,714,621	82,548,978	73,691,832
Animals dipped and immunized:			
Cattle dipped .....	1,707	3,112	2,808
Sheep dipped .....	288,908	167,148	203,602
Swine immunized .....	438,166	274,312	298,211
Total animals dipped and immunized .....	728,781	444,572	504,621
Infectious cars received ...	372	289	743
Cars cleaned and disinfected .....	3,296	2,934	5,341

Enforcement of animal quarantine acts

Violations investigated by the Bureau .....	25	18	14
Violations referred to the Solicitor of Department...	5	2	5

The difference between the number of violations reported to the Bureau and those referred to the Solicitor by the Bureau is due to the fact that in some cases the investigation of alleged violations has not been completed and in others the evidence has been found to be insufficient to warrant legal action. These cases are held in abeyance.

3. Enforcement of the 28-hour law

The 28-hour law requires that no carrier shall confine livestock in cars, boats, or vessels for a period longer than 28 consecutive hours (36 hours if approved by the owner) without unloading them in a humane manner into properly equipped pens for rest, water and feeding. The purpose of the Act is to prevent cruelty to animals, losses to the nation's food supply and losses to producers. By the over-confinement, improper handling and by not watering and feeding as



required by the Act, livestock lose weight, and in many instances die, causing loss to the producer and losses in the nation's food supply. During the 1946 fiscal year, 2068 violations were reported, 244 violations were referred to the Solicitor, and 420 to the Department of Justice for necessary action. During the year, 1,110 cases were terminated, resulting in 993 convictions. The total amount of penalties assessed for violations amounted to \$91,250, which is approximately three times the funds appropriated for the administration of the Act.

4. Determination by inspectors in the field of the existence of disease

Dourine of horses: In continuing the cooperative work with State authorities to determine the existence of dourine of horses, satisfactory progress was made. The outbreak which occurred in Arizona, California, and Nevada in 1942 is now confined to one of the Indian reservations in Arizona. Work in the field consists of drawing blood samples from horses and forwarding serum from each sample to Washington for the complement-fixation test in the Bureau's laboratories. All horses found by the test to be affected with dourine are destroyed. The only infection disclosed was in two horses in the State of Arizona on one of the Indian reservations where the work is carried on in cooperation with the Office of Indian Affairs. The disease exists in the same general region in the Republic of Mexico and the Bureau continued its cooperation with Mexican authorities in testing blood samples submitted from that area, of which 368 gave a positive reaction to the complement-fixation test.

Anthrax: Bureau employees continued to furnish assistance in administering preventive treatment to Indian owned cattle on reservations where anthrax infection is known to exist.

Investigations of suspected cases of foot-and-mouth disease: Prompt and careful investigation was made of all reports of cases suspected of being foot-and-mouth disease. The importance of immediately investigating reports is greatly enhanced at the present time by the existence of foot-and-mouth disease in Mexico. Following reports received from Mexico on December 18 which indicated the presence of vesicular stomatitis, a disease closely resembling foot-and-mouth disease, two Bureau veterinarians were sent to Mexico to assist in identification of the disease. On December 26 the disease was diagnosed as foot-and-mouth disease by both Mexican and Bureau veterinarians.

## 5. Inspection and quarantine of import animals

Inspection: All livestock for importation were inspected to determine their freedom from disease as provided by law. Over 575,000 head of livestock were inspected at the various ports of entry. During the year, 6,636 head of livestock were refused entry on account of disease and a few detained for further observation and testing for the purpose of determining their freedom from infection. The number and kind of animals inspected were as follows:

<u>Ports of entry</u>	<u>Cattle</u>	<u>Swine</u>	<u>Sheep</u>	<u>Goats</u>	<u>Horses and Mules</u>	<u>Asses</u>	<u>Others</u>
Ocean ports ...	1,126	134	537	1,429	198	---	128
Canadian border ports .....	88,129	959	4,699	18	13,427	1	25
Mexican border ports .....	459,945	142	2,119	3	2,885	55	7
Total .....	549,200	1,235	7,355	1,450	16,510 <sup>1/</sup>	56	160

<sup>1/</sup>Of this number 51 were mules.

Following advice from the United States Embassy in Mexico City of the existence of foot-and-mouth disease on December 26, the Bureau ceased inspection of ruminants or swine from Mexico. This temporary action was followed on December 31 by a quarantine order by the Department. Four Bureau veterinarians were sent to Mexico at once to observe eradication measures and to advise with Mexican authorities for the protection of our livestock industry. At the present time one veterinarian is detailed there.

Certification of pedigrees of imported registered livestock: During the fiscal year 1946, a total of 25,972 purebred animals were certified, an increase of 3,641 animals or 16 percent more than the previous year. Certification of animals by species were: 116 horses; 21,482 cattle; 3,062 sheep; 647 swine; and 665 dogs.

## 6. Supervision over the importation of hides and other animal by-products, forage, etc.

Work under this project is entirely regulatory and was accomplished without any changes in the usual program. Supervision was exercised over the entry of various animal byproducts, hay, and straw, which may be the means of introducing the infections of livestock diseases. Such products included more than 81,371,966 import hides and skins, of which more than 1,233,296 were restricted and handled at destination establishments under supervision. A total of 389 railway cars and a large number of trucks and ship compartments used in the transportation of restricted import products were disinfected, as well as premises involved in the handling of these products. Since the outbreak of foot-and-mouth disease in Mexico the utmost vigilance is necessary to prevent the introduction of the disease by these products.

# 7. Inspection and testing of animals for export

As provided by law, direct supervision was given to the installation of stalls and other accommodations on more than 70 vessels for the safe transport and humane handling of export animals. This work was done in cooperation with the War Shipping Administration. During the year over 126,000 animals were inspected prior to exportation in accordance with Department regulations and in order to meet the requirements of destination countries. The export inspections have increased materially the past three years. Inspections during the past year increased more than 50% over the previous year. The number and kind of animals inspected for export were as follows:

<u>Kind of Animal</u>	<u>To</u>			<u>Total</u>
	<u>Canada</u>	<u>Mexico</u>	<u>Other Countries</u>	
Cattle.....	186	12,181	24,622	36,989
Swine.....	7	12,514	282	12,803
Sheep.....	28	9,298	271	9,597
Goats.....	4	471	333	808
Horses.....	185	744	61,723	62,652
Mules .....	1	818	2,479	3,298
Donkeys .....	--	8	35	43
Other animals ....	211	4	--	215
Total .....	622	36,038	89,745	126,405

# 8. Eradicating cattle ticks

General: The cattle fever tick is the only natural carrier of the disease known as splenic or tick fever of cattle, which was formerly a serious obstacle to the cattle industry of the South. Wherever it is eliminated, the disease is eradicated and the troublesome and expensive quarantine restrictions and other losses chargeable to this parasite are removed. Most of the country formerly tick infested is now tick free.

Infestation in Florida: During December 1945 fever tick infestation was found in Highlands County, Fla., and further investigation has shown that this infestation has spread to several counties in central Florida. A systematic eradication campaign was undertaken at once and effective June 20, 1946, the infested area, which includes Glades, Highlands, and Okeechobee Counties and parts of Osceola and Polk Counties, was placed under Federal quarantine. This quarantine order also continued the quarantine in Texas. It also requarantined the Island of Puerto Rico where the final or clean-up work in the tick-eradication program has not been effective and considerable reinfestation occurred during the past year.



Ticks from Mexico: Another continuing source of the danger of re-infestation is by the introduction of fever ticks on stray or smuggled animals from Mexico. All Mexican territory adjacent to the international boundary along the lower Rio Grande River is tick infested. In adjacent areas in the United States it has been necessary to maintain and patrol a buffer quarantined area on a narrow strip of Texas country along this border from Del Rio to the Gulf of Mexico. On several occasions during the past year fever ticks were brought into that area on Mexican livestock.

Dippings: During the fiscal year 1946, Bureau employees and co-operating agencies engaged in this project supervised 7,129,650 inspections or dippings of cattle and 344,360 inspections or dippings of horses and mules.

Reinfestation in Puerto Rico: Considerable reinfestation was found during the year in Puerto Rico and an extensive dipping campaign is being conducted on that island. In addition to cattle, horses, and mules, it was necessary to treat sheep and goats on infested premises and 205,678 inspections or dippings of these animals were made.

#### 9. Control of hog cholera and related swine diseases

Hog cholera continues to be present in practically all sections of the country and is the most serious and costly ailment of swine. Where it is not kept under control hog producers suffer enormous losses. Swine erysipelas, especially in the Corn Belt, is reported to be more prevalent and there is a growing demand for experienced veterinary assistance in its diagnosis and to prescribe effective control measures. Usually but one veterinarian is assigned to this project in a State and there is, therefore, a large demand for the services of these employees to give advice on swine ailments, how they may be avoided, and to correctly diagnose disease when it occurs. The volume of work on this project is indicated in the following table:

SUMMARY OF HOG-CHOLERA-CONTROL WORK,  
FISCAL YEAR 1946

State	Meetings		Farm in- spections and consul- tations	Post- mortem examina- tions	Farms visited on request	Outbreaks reported to Bureau
	Num- ber	Attend- ance				
Alabama	- -	- -	2,699	44	485	61
Arkansas	2	57	265	12	30	37
Florida	2	151	1,094	87	137	325
Georgia	- -	- -	1,987	6	17	2
Idaho	- -	- -	812	57	63	7
Illinois	28	600	4,362	347	364	132
Indiana	28	875	509	14	28	5
Iowa	108	7,267	5,652	382	392	562
Kansas	- -	- -	221	10	18	8
Kentucky	1	31	1,236	9	48	27
Maryland	11	1,146	3,642	56	314	92
Michigan	- -	- -	981	13	59	21
Mississippi	23	613	1,070	3	53	15
Missouri	- -	- -	1,658	33	33	17
Nebraska	6	527	915	88	296	25
North Carolina	- -	- -	1,216	43	537	65
Ohio	- -	- -	93	3	5	22
Oklahoma	1	6	49	1	9	11
South Carolina	11	3,896	853	12	118	68
South Dakota	- -	- -	820	24	45	184
Tennessee	1	40	1,074	61	101	59
Texas	1	100	2,733	20	231	341
Washington	- -	- -	832	9	8	8
Wisconsin	8	549	521	92	152	6
Total ...	231	15,858	35,294	1,426	3,543	2,100

### (e) Meat Inspection

Objective: To administer the Meat Inspection Act, the Horse Meat Act, and the Imported Meat Act, and the regulations promulgated thereunder; to conduct research on unusual biochemical, pathological, and zoological conditions that arise in connection with Meat inspection.

#### The Problem and Plan of Work:

- (1) Meat Inspection Service: The Meat Inspection Service has for many years been an important and fundamental influence in the production, marketing, and distribution of livestock and meat and meat products. Since approximately 7.5 percent of all animals slaughtered for food are affected with some abnormal or diseased condition which is seldom apparent except to especially trained inspectors, it is necessary that such inspectors examine individually each animal slaughtered for food purposes. Also, since meat and meat products are highly perishable and readily contaminated, their processing, preparing, and packing must be conducted in adequately equipped plants under close inspectional supervision.

Condemned meat and meat products must be destroyed under strict supervision to prevent their use as human food and to prevent their contaminating other meat and meat products during handling.

To assure the wholesomeness of processed meat and meat products it is necessary to control the use of ingredients going into their preparation. These are also inspected for wholesomeness and only those are permitted to be used which are fit and will in no way affect adversely the wholesomeness of the meat and meat products.

All labels used at inspected establishments on meat and meat products must be approved in advance of their use. Labels are required to inform the purchaser concerning the articles on which they are used. Also a label is not permitted to be used if it contains any false or misleading statement or other feature.

Foreign countries accept meat and meat products from this country only if Federally inspected and passed and identified as such. Export shipments are identified with special meat inspection export stamps. However, to meet the requirements of certain countries, special meat inspection certificates are also furnished. This background of inspection for American export meat and meat products has maintained an open market for these products throughout the world.



Under the Import Meat Act and the Meat Inspection Act, the Secretary of Agriculture may determine what meat and meat products may be offered for import by countries having a national system of inspection which is the substantial equivalent of the system maintained in the United States. Each consignment is carefully inspected to ascertain that only meat and meat products which have been properly certified from abroad are accepted and that they are sound, wholesome, and otherwise fit for food and truthfully labeled. Through this procedure imported meat and meat products are required to comply with the same standards as those for similar domestic products.

- (2) Research related to meat inspection: It is imperative that proper diagnosis be made of diseased or other questionable conditions encountered in food-producing animals at the time of slaughter. This prevents the distribution of unwholesome meat or meat products and assists in the conservation of our meat supply. To accomplish this, an immediate investigation is required of unusual biochemical, pathological, and zoological conditions which arise.

#### Examples of Progress and Current Program:

1. Meat inspection operations at packing plants under the Federal Meat Inspection service

Slaughtering: The decline in the rate of slaughter for all species during the fiscal year 1946 as compared with that of the two previous years, in spite of the larger number of establishments operating under the inspection during the 1946 fiscal year, is traceable to the marked reduction in the slaughter by large packers who claimed they could not maintain a normal volume of slaughter and comply with price control regulations. With the maintenance of inspection in a larger number of plants and localities than at any time in the past and with the prospect of a rate of slaughter and production of meat products at least as large as in the 1946 fiscal year, the need for inspectors continues to be as great as for the two preceding years. Normally, approximately 70% of all meat animals killed annually are slaughtered and processed under Federal inspection. It is estimated that about one-half of the remainder are slaughtered by farmers on the farm.

The following statistical data indicate the volume and scope of slaughtering activities:

Number of Establishments Covered

Fiscal Year	Establishments	Cities and Towns
1941	668	257
1942	679	264
1943	842	336
1944	896	343
1945	899	344
1946	941	372

Animals Inspected, Ante-Mortem and Post-Mortem

Ante-Mortem Inspection

Fiscal Year	Animals Passed	Animals Suspected	Animals Condemned	Total Animals Inspected
1941	81,818,138	243,005	31,763	82,092,906
1942	85,777,095	251,804	34,291	86,063,190
1943	95,156,504	248,981	43,511	95,448,996
1944	117,769,389	276,458	55,789	118,101,636
1945	94,130,084	262,347	46,922	94,439,353
1946	82,550,004	233,737	34,049	82,817,790

Post-Mortem Inspection

Fiscal Year	Carcasses Passed	Carcasses Condemned	Total Carcasses Inspected
1941	81,799,343	262,848	82,062,191
1942	85,749,940	278,012	86,027,952
1943	95,082,760	320,778	95,403,538
1944	117,656,285	387,774	118,044,059
1945	94,028,231	361,269	94,389,500
1946	82,462,169	319,091	82,781,260

Inspection of Animals by Species

Ante-Mortem Inspections

	1941	1942	1943	1944	1945	1946
Cattle..	10,131,469	11,767,096	11,577,874	12,922,460	14,528,808	12,589,299
Calves..	5,396,483	5,548,431	5,093,324	6,280,148	7,677,057	6,479,866
Sheep & Lambs..	17,817,588	18,555,117	21,817,259	23,852,147	22,678,156	20,949,551
Goats...	5,476	9,518	30,960	10,524	10,964	14,654
Swine...	48,727,238	50,152,218	56,889,559	74,975,659	49,484,599	42,680,456
Horses*	14,652	30,810	40,020	60,698	59,769	103,964
Total.	82,092,906	86,063,190	95,448,996	118,101,636	94,439,353	82,817,790

Post-Mortem Inspections

	1941	1942	1943	1944	1945	1946
Cattle..	10,126,861	11,761,746	11,572,285	12,915,664	14,518,519	12,581,268
Calves..	5,393,566	5,544,745	5,089,331	6,273,537	7,667,156	6,463,209
Sheep & Lambs..	17,811,612	18,547,305	21,804,016	23,837,737	22,664,800	20,953,511
Goats...	5,452	9,498	30,891	10,503	10,893	14,637
Swine...	48,710,059	50,133,871	56,867,080	74,946,117	49,468,458	42,664,755
Horses*	14,641	30,787	39,935	60,501	59,674	103,880
Total.	82,062,191	86,027,952	95,403,538	118,044,059	94,389,500	82,781,260

\* Horses are slaughtered and their meat is identified as such and it is handled and prepared in separate establishments from those handling cattle, calves, sheep, swine, and goats.

Processed meat and meat food products: Each type of meat processing requires the application of detailed inspection procedures by specialists to assure cleanliness, truthful labeling, and the use of pure and wholesome processing materials. Statistical data follows:

Meat and Meat Food Products Prepared and Processed Under Federal Inspection Classified by Fiscal Years

<u>Fiscal year</u>	<u>Pounds</u>
1941	10,514,837,866
1942	12,039,492,563
1943	14,292,716,225
1944	16,707,585,974
1945	13,408,978,079
1946	12,250,086,608



Meat and Meat Food Products Classified by Type of Product

Product	1945	1946
	Quantity (Pounds)	Quantity (Pounds)
Placed in cure:		
Beef .....	105,995,196	107,589,524
Pork .....	2,806,340,563	2,591,913,574
Smoked and/or dried:		
Beef .....	57,599,760	40,040,841
Pork .....	1,832,666,162	1,605,517,478
Sausage:		
Fresh finished .....	482,693,309	419,898,891
Smoked and/or cooked .....	1,101,017,588	1,080,553,779
To be dried or semi-dried..	145,436,630	127,447,693
Loaf, Headcheese, chili con carne, jellied prod., etc..	238,704,866	235,914,975
Cooked meat:		
Beef .....	32,001,488	31,308,795
Pork .....	369,791,177	408,748,500
Canned meat and meat food products:		
Beef .....	233,604,900	219,774,073
Pork .....	905,938,896	739,017,397
Sausage .....	210,943,237	96,067,771
Soup .....	292,735,653	396,123,223
All other .....	714,455,038	537,707,445
Bacon, sliced .....	454,974,882	487,192,122
Lard:		
Rendered .....	1,424,657,052	1,301,144,235
Refined .....	1,163,382,544	1,095,261,253
Rendered Pork Fat:		
Rendered .....	143,801,698	86,737,003
Refined .....	86,624,177	59,794,041
Oleo Stock .....	121,405,231	111,116,689
Edible tallow .....	93,696,990	79,580,769
Compound containing animal fat .....	275,478,903	285,733,342
Oleomargarine containing animal fat .....	49,645,183	39,169,739
Miscellaneous .....	55,700,235	42,066,291
Horse meat:		
Cured .....	814,834	5,451,244
Chopped .....	8,871,887	13,185,715
Canned .....	- - - - -	6,030,206
Total .....	13,408,978,079	12,250,086,608

Specification Examination of Meat and  
Meat Food Products

Branch of Government	Fiscal Year 1944 (Pounds)	Fiscal Year 1945 (Pounds)	Fiscal Year 1946 (Pounds)
Navy Department .....	494,766,677	631,898,252	414,461,302
Commodity Credit Corp. Lend Lease	292,123,169	425,161,608	336,042,746
Coast Guard .....	12,649,763	17,231,340	5,888,835
War Shipping Administration .....	3,912,419	4,164,486	1,909,556
Marine Corps .....	823,376	313,978	87,929
Department of Interior .....	708,556	656,633	591,556
Veterans Administration .....	620,825	568,134	893,236
War Department (Engineers) .....	279,224	181,988	139,311
Maritime Commission .....	209,052	575,686	313,644
Department of Justice .....	122,168	107,880	42,224
All Others .....	- - - -	144,351	22,826
Total .....	806,215,229	1,081,004,336	760,393,165

Of the total quantity of meat and meat food products examined for conditions and conformance to specifications for other Government agencies during the fiscal year, 756,342,033 pounds were passed and 4,051,132 pounds were rejected.

Labels: Packers and processors are required by law to submit their labels for approval prior to use. In 1946, 15,860 new labels and sketches for proposed labels were submitted for approval--an increase of 1,803 over 1945. Actions taken are indicated below:

Item	Fiscal year 1945	Fiscal year 1946
Number of labels and sketches approved .....	12,365	13,756
Number of labels approved for imported meat.	74	59
Number of labels and sketches refused approval .....	1,624	2,104
Total number of labels and sketches reviewed .....	14,063	15,919

Certificates of exemption: During the year 1946, certificates of exemption from inspection were issued in accordance with Section 21 of the Meat Inspection Act. During this period 31 certificates were canceled, leaving a total of 435 outstanding. Certificates of exemption are issued to retail butchers and dealers who usually make interstate shipments in supplying their customers. Periodic inspections are made of the premises of these butchers and dealers to assure that the meat and meat products are produced under sanitary conditions and that the meat inspection requirements are being met.

Violations of the Meat Inspection Act: Violations consist principally of transportation or offering for transportation of non-federally inspected meat in interstate commerce. Convictions were obtained in 26 such violations, resulting in the payment of fines ranging from \$25 to \$620 and totaling \$3,196. In addition, six defendants were sentenced to jail for periods varying from 60 days to 1 year. These sentences were suspended, some on payment of fines and others being placed on probation for a period of one year.

2. Determination of adulteration and other objectionable conditions in meat and meat food products by laboratory analysis

Seven chemical laboratories are strategically located throughout the country. As part of their inspectional control, meat inspectors send to these laboratories samples of meat products and many other materials for chemical and microscopic examination to supplement their inspection. Laboratory examinations are made to detect adulteration and the presence of prohibited or deleterious substances.

Summary of Samples Examined for the Fiscal Year 1946

	<u>Number examined</u>	<u>Reported adversely</u>
Meat and meat food products .....	13,083	2,123
Edible Fats and Oils .....	555	98
Inedible Grease .....	36	5
Cereals, spices, and condiments ....	4,949	185
Curing materials .....	1,980	64
Gelatin .....	154	2
Marking fluids .....	269	10
Colors .....	40	1
Denaturing Oils .....	357	6
Water .....	1,578	146
Miscellaneous .....	1,093	146
Totals .....	24,094	2,786

3. Inspection of Imported Meat and Meat Food Products

<u>Fiscal Year</u>	<u>Pounds</u>
1944	57,400,875
1945	92,178,607
1946	64,484,876



4. Chemical, pathological, and zoological investigations relating to meat inspection

During the past fiscal year experiments were carried out to ascertain the length of time trichina larvae would survive in ground salted pork kept under conditions where evaporation of moisture could not occur and under conditions of limited evaporation. The findings have a practical application in the destruction of trichinae in pork by commercial meat curing procedures, and have formed the basis for meat inspection regulations governing the destruction of trichinae in pork by the application of salt.

Results of the experiments to determine the effects of different methods of cure on the composition and nutritive value of hams showed that

- (1) When hams were cured by the artery or quick-cure, by the dry-cure, and by the slow brine cure methods the protein in each lot of hams was of as high digestibility and growth-promoting value as the protein in fresh hams.
- (2) When the protein in each lot of cured hams and that in the fresh hams was supplemented with the amino acids cystine and methionine, the nutritive value of the protein was considerably enhanced.
- (3) The fat from each lot of cured hams had as high nutritive value as the fat in fresh hams.
- (4) Cured hams have a high nutritive value.

At the pathological laboratories in Washington, Chicago, Denver, diagnoses were made of approximately 700 specimens, representing miscellaneous diseases, infections, tumors, and other pathological conditions encountered in food animals. Laboratory investigation of an abnormal condition encountered in certain lots of Minnesota hogs which was characterized by brownish discoloration of the fat and a foreign odor, indicated that the abnormality was caused by some substance in the diet of the hogs. In continuance of the investigation, feeding tests to identify the substance in the locally-used feed stuffs responsible for the condition are being made at the Minnesota Agricultural Experiment Station.

Special studies were made on congenital pigmentation of the bones in hogs (osteohemochromatosis or porphyria), and on an abnormal condition of the liver in sheep caused by massive stomach worm infestation. Recommendations for the disposition of affected carcasses were formulated from the information obtained.

Data that were obtained on the incidence and classification of tumors in food animals were compiled and recorded for the information of agencies engaged in cancer research

A report was published on the studies of a previously undescribed disease of swine similar to Hodgkin's disease in man. This article, based largely on material obtained in meat inspection diagnosis, was published in the January 1946 issue of the American Journal of Pathology. The recognition of this disease in swine has opened a new approach for experimental studies on the cause and treatment of Hodgkin's disease in man.

A disease resembling tuberculosis, found in carcasses of cattle from accredited herds in California, was identified as coccidioidal granuloma.

(f) Virus Serum Toxin Act

Objective: To insure that all veterinary biologics produced by licensees are, in fact, not worthless, contaminated, dangerous, or harmful, and to prevent insofar as possible, the interstate movement or importation of any veterinary biologic product, organism, or vector that is worthless contaminated, dangerous, or harmful.

The Problem and its Significance: Biological products that are not properly prepared and tested may be worthless, contaminated, dangerous, or harmful to animals treated therewith. They may either fail to prevent or control an outbreak of disease and may even be the means of spreading disease. A license issued by the Secretary should carry with it reasonable assurance to the livestock producer that the products when properly used will afford protection and not be harmful to his animals. A biologic that is contaminated or otherwise improperly prepared not only may endanger the herd that is treated but may prove disastrous to other herds in the community through failure of the product in some respect.

General Plan: This work involves the detailing of sufficient inspectors to the establishments producing anti-hog-cholera serum and hog-cholera virus so that all operations connected with the production and testing of these products are carried out under direct supervision. Inspection of plants producing biological products other than anti-hog-cholera serum and hog-cholera virus is made periodically or upon instructions for special reasons.

Progress and Current Program: Considerable stocks of veterinary biological products were carried over from 1945. Economic conditions in war ravaged countries did not enable them to purchase biological products in quantities as expected. However, considerable quantities of products were exported by UNRRA during 1946. The present export demands for biological products are considerably above the fiscal year 1945 and undoubtedly will remain high until foreign countries are able to produce products for their own use. It is expected that continued maximum prices and increase of the livestock of the world will strengthen the demand for biological products, even though livestock in this country may diminish in numbers. A number of licensees plan to increase production materially as soon as building and supply conditions warrant. A number of licensed establishments have made changes in organization or procedure looking to increased production and distribution of biological products.

The progress and expected extent of the work under this project is reflected in the following table:



	<u>Actual</u> <u>F.Y. 1946</u>	<u>Estimated</u> <u>F.Y. 1947</u>	<u>Estimated</u> <u>F.Y. 1948</u>
(a) Establishments producing anti-hog-cholera serum and hog-cholera virus...	39	39	39
Production (cc.):			
Serum (preserved product).....	1,212,757,000	1,283,494,000	1,412,843,000
Virus:			
Simultaneous .....	90,836,000	95,377,000	104,914,000
Hyperimmunizing...	242,004,000	254,167,000	279,583,000
Inoculating .....	1,105,000	1,160,000	1,276,000
Animal inspections..	3,387,000	3,555,000	3,910,000
Tests supervised....	16,700	17,635	19,390
(b) Establishments producing other biologics .....	39	39	39
Production:			
Cc. ....	430,316,000	434,592,000	478,051,000
Milligrams.....	37,096,000	38,950,000	42,845,000
Disks .....	406,000	408,000	448,000
(c) Products destroyed (all kinds):			
Cc. ....	37,613,000	39,493,000	43,442,000
Milligrams .....	4,037,000	4,238,000	4,662,000
Disks .....	60,000	88,000	96,000
(d) Export certificates issued .....	776	814	895

(g) Marketing Agreements, Hog Cholera Virus and Serum

Objective: To insure that the control agency and handlers of anti-hog-cholera serum and hog-cholera virus observe the provision of the marketing agreements and order.

The Problem and its Significance: The Serum and Virus Law of August 24, 1935, and Marketing Agreement of December 7, 1936, stress the economic importance of producers and other handlers maintaining an adequate supply of serum and virus at all times, and aim to prevent undue and excessive fluctuations of prices, unfair methods of competition, and unfair trade practices.

General Plan: The marketing agreement is enforced by a control agency selected by the Secretary and handlers, whose acts are subject to review by the Secretary and his representatives. The work relates mainly to reviewing acts of the control agency, attendance at meetings, and the assembling of economic data relating to the production, sales and prices of anti-hog-cholera serum and hog-cholera virus.

Progress and Current Program:

The following table gives comparative figures by fiscal years on the number of handlers operating under the marketing agreement:

	Actual June 30, 1944	Actual June 30, 1945	Actual June 30, 1946	Estimated 1947 and 1948
Distributor-Handlers..	199	207	215	220 (each year)
Producer-Handlers ....	38	37	37	37
Volume Contract Purchasers .....	7	9	4	4

This agreement has been entered into for the purpose of insuring an adequate supply of anti-hog-cholera serum and hog-cholera virus, stocks of which are diminishing. Adequate supplies of anti-hog-cholera serum and hog-cholera virus are essential in the routine immunization of swine and the furtherance of maximum hog production, and especially for use in any emergency arising from an extensive outbreak of hog cholera.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
<u>Special Research Fund, Department of Agriculture (Bureau of Animal Industry)</u>			
For special research projects and four regional research laboratories, improvement of sheep and swine through application of breeding methods and for studies of diseases of livestock and poultry .....	\$333,261	\$364,500	\$364,500
<u>Working Fund, Agriculture</u>			
<u>Agricultural Research Administration</u>			
<u>Bureau of Animal Industry</u>			
For studies of factors affecting the keeping quality of bacon for the War Department .....	3,390	8,500	- -
<u>Penalty Mail Costs, Department of Agriculture (Allotment to Bureau of Animal Industry)</u>			
For cost of penalty mail pursuant to Public Law 364..	28,017	24,700	30,660
TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL FUNDS .....	364,668	397,700	395,160





## BUREAU OF DAIRY INDUSTRY

Objective: (1) To increase the milk and butterfat producing efficiency of dairy cows; (2) to determine the nutritional value of milk, and the effect of the nutrition of the cow upon the milk produced, the nutritional requirements of calves, cows, and bulls to maintain optimum levels of usefulness, the value of feeds, feed constituents, and feeding regimes as sources of nutrients, and the physiological factors affecting the general economic usefulness of dairy cattle; (3) to improve the quality of products made from milk; and (4) to effect greater efficiency in manufacturing methods; to develop new milk products and to provide for the more efficient utilization of milk byproducts.

The Problem and its Significance: There are about 26 million cows in the United States kept for milking purposes, the average butterfat production of which is about 134 pounds a year. This production is too low for profit. Only one-third of these cows actually return a profit to their owners. At least 90 percent of the animals raised for dairy purposes should possess an inheritance for profitable production. This may be accomplished through scientific methods of selection and breeding.

The national dairy herd must be fed in a manner that will maintain the health of the animals and insure the economical production of milk having maximum nutritive and health-giving properties. Research is required to determine the most efficient and economical methods of feeding for milk production, the relation of the cow's diet to her health and reproductive functions, and to the nutritive properties of the milk produced.

Quality control in the manufacture of dairy products is possible only through a knowledge of the bacteriological and chemical changes involved and of the application of this knowledge to factory practices. The basis for formulas applicable to factory conditions is obtainable only through research. Defects in quality are usually the result of insufficient information concerning the factors influencing quality and of the methods for controlling these factors under commercial conditions.

General Plan: The work is carried on through field and laboratory experiments in cooperation with state colleges, agricultural experiment stations, and extension services, other Government agencies, dairymen, and manufacturers of dairy products. Some phases of the work are conducted cooperatively in every state and in Hawaii and Puerto Rico.

Experiments are conducted to ascertain the comparative effects of different methods of breeding in an attempt to fix an inheritance for high and uniform levels of producing ability in dairy cows; to develop methods for judging the potential producing ability of heifers at an early age in order to avoid raising to maturity those heifer calves that should be discarded because of their inferior potential milk-producing ability, and to determine the effect of breeding and feeding practices on the level and economy of milk and butterfat production.

Research in animal nutrition and physiology includes investigations to determine the nutritional value of milk and the effect of the nutrition of the cow upon the milk produced; the energy, protein, mineral, vitamin, and other nutritional requirements for calves, cows, and bulls to maintain optimum levels of usefulness; the value of various feeds, feed constituents, and feeding practices as sources of nutrients, and the physiological factors affecting the general economic usefulness of dairy cattle.

Research also is conducted to discover the basic difficulties in the production of market milk and to devise remedies which can be readily and economically applied; and to increase the returns to the producers of milk by increasing consumption through improvements in the quality of manufactured milk products, by lowering the cost of manufacture through increased efficiency and reduction in the proportion of undergrade products, and by converting byproducts of milk into marketable form.

Examples of Progress and Current Program: The following are examples of recent accomplishments under this appropriation, by principal projects:

1. Investigations of the influence of breeding, feeding and management practices on efficiency of production:

More Jersey heifers conceive and average fewer services per conception when mated with young bulls (Jeanerette, La.). At the Jeanerette, La., station the conception rate of heifers was much higher when they were bred to young bulls than when bred to aged proved bulls. Since 1939, heifers have been bred to yearling or two-year-old bulls (sons of proved sires) and only 6% have failed to conceive. Previous to that time only aged proved sires were used and 18% of the heifers failed to breed. This use of young bulls affords an opportunity to determine their breeding value before using them extensively in the herd.

Quality of sire more important than method of breeding for developing high production. The Holstein breeding project at Beltsville is showing that by using unrelated proved sires milk production is progressively increased. It has also shown that in some cases high production is maintained through inbreeding with proved sires. In the Jersey breeding project proved sire breeding was carried on within families and by crossing families to determine the merits of these methods of breeding. An analysis of the results to date shows that the continuous use of proved sires not only brings about an increase in the level of production but also an increase in uniformity of production. The pattern of breeding did not seem to be a factor. The same results were obtained when proved sires were used, regardless of the degree of relationship between them and their mates.

Progeny testing of bulls extended in artificial breeding associations. Sires produced in the Bureau's Holstein and Jersey herds are being used increasingly by artificial breeding associations. Ten more Holsteins, 4 of them proved sires, and 4 Jerseys have been loaned to associations, bringing the total in use to 25 Holsteins and 8 Jerseys. To date a total of 50 bulls from Beltsville and 6 from other Bureau stations have been used in artificial breeding associations. In one association alone



Beltsville bulls have sired more than 12,000 calves. The practice of loaning bulls to artificial breeding associations speeds up the progeny testing of bulls, gives better proof of their transmitting abilities, and extends the usefulness of this superior germ plasm into many farmers' herds.

For many years the Bureau has loaned bulls to cooperating dairymen in areas adjacent to the stations for the purpose of proving their transmitting ability. A recent summary of the progress of this work shows that 332 bulls from 7 stations have 4,619 daughters whose average yearly production was 10,914 pounds of milk and 426 pounds of fat, or 690 pounds of milk and 30 pounds of fat more than the dams' average. Over three-fourths of the bulls increased the level of production of the daughters over their dams. Thus, the benefit of proved sire breeding is passed on through their sons as well as through their daughters.

Reduction in calf mortality. Calf losses have been held to about 1% among 72 calves born in the Jeanerette, La., station's Jersey herd during the past 6½ years. This is in contrast to a mortality of 14% the previous 23 years, even though the feeding and management practices have been about the same. The low mortality is attributed to better care resulting from a specially designed pen. The calves are kept the first month in individual pens on slatted wood floors raised 18 inches above the regular cement floor. The slatted floors hold the bedding but allow the liquid to pass through, thus keeping the bedding and the calf dry. The pens for the young calves are in a room in which drafts are avoided. Similar reductions in calf mortality could account for a considerable saving in raising herd replacements under average conditions.

Pasture improvement work at Lewisburg, Tenn., proves its worth. Bluegrass pasture receiving no special treatment gave a net return in value of milk produced of \$47.86 per acre. A similar plot handled in the same way except that the stubble was mowed twice during the season yielded milk valued at \$55.80 per acre after charging the cost of mowing. One plot plowed and seeded to orchard grass and ladino clover yielded milk valued at \$212.06, while another seeded to orchard grass and white clover yielded \$173.46 per acre. Crimson clover seeded in the fall on bluegrass sod did not live. Korean and common lespedeza seeded on old bluegrass sod did not increase carrying capacity.

## 2. Investigations of the nutritional and other physiological factors affecting the usefulness of dairy cattle:

Unidentified growth-promoting factor (X) in milk. Results obtained with laboratory animals during the past year indicate that the unidentified growth factor (X) previously demonstrated to exist in milk, skim milk, and in foods containing the non-fat solids of milk, also affects reproduction. It was previously reported that a deficiency of X retarded the development and early functioning of the sex organs. By more drastic methods of depleting animals of X, it has now been shown that animals on X-deficient diets may conceive but may fail to bear any young, or may bear exceedingly small litters of young which generally fail to survive. This failure resembles failures due to vitamin E deficiency. It seems unlikely, however, that it

is due to a vitamin E deficiency because the diet contained vitamin E, and the liver extracts used as a source of X, which were shown to prevent this failure, probably did not contain vitamin E. This possibility will, however, be further investigated.

Milk produced by different cows fed in various ways was tested and found to be potent as a source of X, although the same cows appeared to produce a less potent milk when fed grain, hay, and carrots than when on pasture. Milk from cows fed grain and corn silage was intermediate in potency. More work will be done to determine the effect of diet on the X content of milk. More conclusive evidence was obtained during the year that X may improve the growth of rats even when they are on diets that are very low in protein content.

Vitamin A requirements of young calves. Since calves are born with little or no vitamin A stored in their bodies, it is essential that they receive an adequate supply of this nutrient immediately after birth. In previous reports the use and value of colostrum as a source of vitamin A was considered. During the year a table based on the results of experimental work was prepared and will appear in an article in the 1947 Yearbook, indicating the daily amounts of vitamin A that should be fed Jersey and Holstein calves from birth to six months of age, and methods of supplying this vitamin A.

Raising calves on reduced amounts of whole milk. These investigations continue to indicate that heifer calves may successfully be reared without being fed any marketable whole milk, provided they are fed skim milk supplemented with a vitamin A ration. Twenty-six Holstein heifer calves fed skim milk from about three days to six months of age, and 13 fed whole milk to 30 days of age and then skim milk to six months of age have been compared. The results indicate that this milk feeding schedule is practical, and by adopting it for the raising of dairy herd replacements about one billion pounds of whole milk or 40 million pounds of butter could be saved annually for human consumption.

Supplementing the skim milk ration with energy-rich feeds during the first few weeks improved the growth of calves. Cooked flaxseed, ordinary concentrate mixtures, and corn meal were found to be helpful when fed with the skim milk.

Early weaning of calves from skim milk. Calves that have been reared without being fed any marketable whole milk have been weaned from the skim milk diet at 30, 45, 60, 90, and 180 days of age. The results to date continue to indicate that calves can be successfully weaned at earlier ages than is usual in practice (Holsteins at 45 days and Jerseys at 60 days of age) without seriously impairing their growth or disturbing their health. Calves should, however, be induced to eat other feeds at as early an age as possible. Calves fed timothy hay and weaned from skim milk at 30 to 40 days of age developed low-calcium rickets. This can be prevented by the feeding of 3 percent of bone meal.

Use of vitamins to prevent calf mortality. Investigations show that the



feeding of 500 milligrams of ascorbic acid and 100 milligrams of niacin, along with 20,000 to 40,000 International Units of vitamin A fed as cod-liver oil, is not effective in preventing infectious scours in calves. Vitamin A by itself was found to be effective in preventing scours of nutritional origin due to a deficiency of this nutrient. The use of sulfa drugs (sulfaguanidine and sulfathiazole) led to a marked reduction in the incidence of infectious scours.

Calcium requirements of dairy calves subsequent to weaning. In previous work it was shown that calves grow normally from 6 to 12 months of age on diets containing only 0.16 percent calcium. Animals are now being reared on rations containing only 0.14 percent calcium. Some of these animals have now reached 14 months of age. Their weights are not quite maximum and the calcium content of the blood plasma is on the low side of normal--sometimes definitely low. Otherwise they do not show any unfavorable effects of the low calcium feeding. These animals are older and their roughage consumption larger than those which developed low-calcium rickets when weaned onto a ration of grain and timothy hay at 30 to 40 days of age. It seems apparent that the calcium requirements of growing dairy calves from six months to one year of age can easily be met by almost any ordinary combination of feeds.

After making normal growth from six months of age on rations containing only 0.14 percent of calcium, some first heifer calves are now proceeding with their first lactations without definite evidence of difficulty except a calcium content of the blood serum that is slightly below average, evidence of stiffness at times, and an inclination to be off their feet, which conditions may be indications of an approaching calcium deficiency. These animals will be continued on this diet to determine whether definitely deleterious symptoms develop when such low calcium rations are fed to lactating cows.

Anti-rachitic value of alfalfa harvested by different methods. Vitamin D, the anti-rachitic vitamin, does not occur in green-growing plant materials, but is produced in those materials by the action of sunlight on them after they are cut and while they are drying in the field. Hays that are dried without this exposure to sunlight, and silages that are exposed even less to sunlight might, therefore, be deficient in vitamin D. Whether dairy calves will develop rickets when reared on rations containing roughages processed in various ways is now under investigation. The animals have made satisfactory growth, but stiffness and early clinical symptoms of rickets have developed in some of the calves receiving barn-dried hay or silage.

Toxicity of 2,4-D (2,4-dichlorophenoxyacetic acid). It was demonstrated in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering that 2,4-D, a chemical used for weed control, is not toxic to cattle grazing on pasture sprayed with this material or when fed to cattle in considerable doses directly in their rations. The material was not found in their milk.

Use of "synthetic" thyroprotein (or iodoprotein) to increase milk production. Cows fed thyroprotein increased in milk yield, but when fed only



enough feed according to standard methods to maintain them and support their milk yield, they lost weight rapidly. After considerable loss in weight their milk production decreased rapidly until it reached 10 to 15 pounds daily, when it leveled off. Twenty-five percent more feed was required to prevent this rapid decline in body weight and milk production. When this extra feed was given it produced a significant increase in heart rate. Feeding thyroprotein has not yet been found to adversely affect reproduction or the condition of the offspring. More work is necessary to determine the feed cost of the increased milk production brought about by this material and its ultimate effect on the health of the cow.

Relation of nutrition to the reproductive performance of the bull. Results of preliminary experiments on the relation of vitamin A to reproduction in the bull show that one effect of vitamin A deficiency on reproduction is the inability of the bull to breed. The younger the bull when the deficiency occurs the more pronounced is the effect of it. Vitamin A-deficient bulls produce semen that is fertile even though it is of poor keeping quality and contains high percentages of inferior types of germ cells. Under practical feeding conditions gross symptoms of vitamin A deficiency are likely to appear before severe impairment of the bull's reproductive performance occurs.

Effect of methods of harvesting on the nutritive value of forage. In co-operation with the Bureau of Plant Industry, Soils and Agricultural Engineering, and the Production and Marketing Administration, experimental work was undertaken to determine the relative efficiency of harvesting alfalfa hay as (1) silage, (2) barn-cured (or mow-dried) hay, and (3) field-cured hay. It was found that smaller losses of dry matter, protein and carotene occurred when the alfalfa was made into silage. The barn-curing method was the next most efficient. The silage contained 12 percent more protein and the barn-cured hay about 9 percent more than the field-cured hay. Field losses of dry matter and nutrients were greatest with the field-cured hay and least with the silage. The barn-cured hay contained about twice as much carotene and the silage from 6 to 10 times more than the field-cured hay. Milk production amounted to about the same for cows fed the barn-cured and field-cured hays but was 3 percent higher for cows fed silage. There was twice as much vitamin A in the milk produced by the cows on silage as there was in the milk produced by cows fed field-cured hay. The labor and machinery requirements to put up a ton of dry matter were approximately the same for the three methods. Considering the saving in feed and the greater production per unit of feed the silage method accounted for 16 percent and the barn-curing method 9 percent more milk per acre than the field-cured method.

Protein requirements of dairy cows. In an experiment in which milking cows are fed protein at low, medium, and high levels (varying from 1.25 to 1.8 times the protein in the milk with an allowance for maintenance varying from 0.5 to 0.7 pound of protein per 1,000 pounds of live weight) seven cows have completed lactations. In the preliminary results no deleterious effect of the low protein ration, either in the total yield of milk, the percent of protein in the milk, or the health of the cow, is obvious, but the protein in the blood plasma of the cows receiving the low protein ration is significantly lower than in the plasma of the cows receiving the high

protein ration. Cows on the low protein ration did not maintain their body weight during lactation as well as those on the higher protein ration. This experiment will continue for several lactations; no final conclusions are at present justified.

Vitamin A potency of winter milk and butter can be economically improved. The results of the national survey in which 21 States cooperated to determine the vitamin A potency of the butter consumed in the United States were reported a year ago. It has been found possible to double the vitamin A potency of winter milk and butter by feeding alfalfa as silage instead of as hay. This was accomplished at no increase in cost in labor and machinery. It is therefore possible for farmers to improve the vitamin A potency of winter milk and butter by feeding alfalfa silage.

3. Investigations of dairy herd improvement association practices in relation to efficiency of production:

The average production of all cows in dairy herd improvement associations last year was 8,296 pounds of milk and 336 pounds of butterfat. During the year feed and production records of more than 400,000 cows were tabulated and analyzed. The analyses of feed and production records continue to show that higher producing cows return a proportionately greater profit than low-producing cows in spite of the greater feed costs. Cows producing 200 pounds of butterfat per year yielded an average return above feed cost of \$78. Cows producing 400 pounds of butterfat per year yielded an average return above feed cost of \$208, while cows producing 600 pounds of butterfat yielded an average return above feed cost of \$334. Through the years the percentage of low-producing cows in dairy herd improvement association herds has decreased and the percentage of higher producing cows has gradually increased. Approximately 100,000 cows in association herds average more than 425 pounds of butterfat yearly.

Last year 1,487 sires were proved in dairy herd improvement association herds. The daughters of these sires had an average butterfat production of approximately 385 pounds. More than 99 percent of all sires proved in dairy herd improvement associations have daughters whose butterfat production averages more than the 182-pound average for all cows in the United States. The tenth annual list of proved sires containing the summaries of records of 1,618 proved sires was compiled. These sire lists provide dairy-men information that enables them to select breeding stock with some degree of assurance that stock so selected will increase the producing capacity of their herds. During the fiscal year approximately 165,000 production records were received from the States.

The increased funds appropriated for this project for fiscal year 1947 made possible the employment of additional personnel for handling the work. The recording, cross-indexing and filing of data received from the States is rapidly being brought up to date. This phase of the work was considerably in arrears on July 1, last. The next step in the program is to compute and compile milk production data on all animals for which records have been received in order that comparisons may be made to identify and prove sires having an inheritance for transmitting high milk and butterfat producing ability.



#### 4. Investigations of milk and milk products:

Lipase in dried milks. The enzyme lipase is a normal constituent of milk, but if not inactivated in the manufacture of dairy products, it causes the development of unpleasant flavors and odors in these products through the hydrolysis of fat. In making spray-dried whole milk, it is necessary to inactivate the lipase prior to the drying. Preliminary experiments have shown that stirring milk for 5 minutes at 40° C. increases lipase activity as much as tenfold. Lipase may be inactivated by holding milk at 60° C. for 25 minutes or by flash-heating at 90° C. for 5 seconds. The effect on the quality of dried whole milk of different methods of inactivation of lipase is being investigated.

Keeping quality of dried milk in low concentrations of oxygen. By a single evacuation of the air from containers for dried whole milk and replacement with inert gas, it was found possible to reduce the oxygen percentage below 3, and under these conditions the dried milk continued edible for approximately a year. By means of two evacuations with a time-interval between, the oxygen percentage can be reduced below 2 and the keeping time thus extended to about 2 years. After vacuum treatment of dried milk, adsorbed oxygen is slowly released and this increases the percentage of oxygen in the atmosphere in contact with the powder. Vacuum treatment of the dried milk at relatively high temperatures prior to packaging has been suggested as a means of increasing the efficiency of removal of adsorbed oxygen, but it has been found that increasing the temperature of vacuum treatment may actually decrease the efficiency of removal of adsorbed gas. This is due to the reduction of the effective vacuum caused by vaporizing water contained in the dried milk. A drying agent inserted in the vacuum system to absorb this moisture is recommended to avoid this difficulty.

Concentrating lactic acid by freezing and thawing. If dilute lactic acid solutions are frozen and then slowly thawed, the fraction melting first will be of much greater concentration than the starting acid. Dilute lactic acid can readily be concentrated to a 50 percent solution by this method. A concentration to 70 percent is possible. These results show that satisfactory concentration of dilute acid is possible for commercial purposes in that the acid may be shipped with less water in it, thus reducing shipping space and costs.

Riboflavin by fermentation of whey. It has been known for some time that in the production of riboflavin (B group vitamin necessary for human nutrition) by certain types of bacteria the quantity of iron in the media used must be kept within definite low limits in order to obtain high yields of riboflavin. Evidence has also been obtained which shows that riboflavin is not produced in the presence of iron, possibly because of the action, in the presence of iron, of hydrogen peroxide on riboflavin and its precursors. On this basis it has been found possible to increase riboflavin yields by the addition of substances to the media (whey) which inhibit the reaction between riboflavin and hydrogen peroxide in the presence of iron.

Fermentation of milk sugar by yeasts. The yeasts that ferment milk sugar differ from other yeasts in their requirements for growth. These



requirements have been determined and the knowledge thus obtained is being used in an effort to increase the efficiency of the production of alcohol from whey. Evidence has been obtained that milk sugar is fermented directly to alcohol without first being hydrolyzed into the simpler sugars that compose it.

Butter from butter oil. Butters prepared from mixtures of butter oil and plastic cream (cream containing 70 percent butterfat) in differing proportions with water and dried skim milk are remarkably similar in firmness, appearance and spreadability to one another and to butters prepared from cream by the customary process. Butters containing butter oil soften and melt more rapidly than genuine butters or those made from plastic cream. These facts suggest that churned butter may contain very little dispersed fat and that only a small portion of dispersed fat is needed in reconstructed butters.

Bakers' cheese from dried skim milk. In an attempt to overcome to some degree the shortage of bakers' cheese, a method of manufacture from reconstituted dried skim milk was developed. The cheese made in this way was of as good quality as the regular bakers' cheese and of more uniform quality. This method of making bakers' cheese lessens the cost of such cheese in areas where it cannot be made from locally produced skim milk. From 1.8 to 2.2 pounds of bakers' cheese can be made from 1 pound of dried skim milk.

The phosphatase test applied to cheese. The phosphatase test developed for detecting the use of raw or underpasteurized milk in making Cheddar cheese has been simplified and made more precise by changes in reagents and technique. It will next be applied to cheese of other types.

Effects of pasteurization of the milk on the characteristics of Cheddar cheese. Pasteurization of the milk causes ripening of the cheese to be slower, but prevents the development of undesirable flavors and excessive acidity. Pasteurization of the milk decreases the rate of curing in cheese from milk initially of poor quality, but has little effect on the rate of curing in cheese from milk initially of high quality. Cheese made from pasteurized milk becomes soft at a slower rate than cheese made from non-pasteurized milk, especially if the milk was initially of poor quality.

Changes in evaporated milk during storage. If evaporated milk is stored longer than about six months, undesirable characteristics may appear. These include rising of fat, settling of protein, and separation of salt crystals. The viscosity of all evaporated milk drops during storage at room temperature, increasing the rate of rise of fat. This decrease in viscosity can be greatly retarded by storage of the milk at refrigerator temperatures. Settling of protein is most rapid in evaporated skim milk. The fat in evaporated whole milk buoys up the protein and homogenization aids further by binding the protein to the fat. Analyses were made of the crystals that form in evaporated milk, which were found to consist mostly of calcium citrate. Small percentages of magnesium and phosphorus were also present. The formation of these crystals in evaporated milk may easily be brought about by seeding or by adding a calcium salt and a citrate, but no means have yet been found to inhibit their formation and growth.

Penicillin and streptomycin as possible aids in sterilization. Penicillin in relatively low concentration is effective in retarding growth and killing many species of spores. However, a few fairly common species are highly resistant to the action of penicillin. In practical concentrations it does not protect against the formation of the bacterially-produced toxic substance responsible for botulinus poisoning. Hence, penicillin cannot be recommended for use in the preservation of condensed milk or other foods. Streptomycin has been shown to be even less effective than penicillin as a food preservative.

Preserving cream by freezing. It has been found that the tendency of the fat and protein of frozen cream to separate when the cream is thawed can be lessened by using cream only from freshly drawn milk, maintaining the cream at such a temperature that the fat remains fluid and well dispersed until it is frozen, freezing quickly and maintaining the frozen cream at a temperature of  $-25^{\circ}$  C. or lower. The presence of a fraction of a percent of an edible stabilizer causes the cream to be more viscous and more homogenous on thawing.

Aging of ice cream mix. Preliminary work on the aging of ice cream mixes has shown that the changes characteristic of aging are reversible. Warming an aged mix to  $100^{\circ}$  F. gives it the characteristics of a mix that has not been aged. The aging reaction is apparently a recovery from the effects of heating incident to pasteurization and homogenization of the ice cream mix.

5. Administration and enforcement of the process (or renovated) butter act (regulatory):

During the year emphasis was given the improvement of factory and procurement sanitary practices. With one exception, all of the qualified process butter factories are now housed in new or remodeled buildings and some new and modern equipment was installed last year.

The consolidation of truck routes effected two years ago by the factories was continued. Through the use of feeder routes operated more frequently some butter was obtained directly from the farm where it was made. More new metal shipping containers were purchased and put into use. A new method of handling packing stock was installed at one factory and a new emulsifying process was adopted at another. These practices have tended to improve sanitation.

Public Law 427, approved June 24, 1946, corrected weaknesses in existing law relating to process butter manufacture. The revised law requires continuous inspection at each process butter factory to assure consumers of a clean and wholesome product. Butter and other ingredients will be condemned and destroyed if found to be putrid, decomposed, or otherwise unfit for use in the manufacture of process butter.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations: 1946	Estimated obli- gations, 1947	Estimated obli- gations, 1948
Special Research Fund,			
Department of Agricul-			
ture (Bureau of Dairy			
Industry):			
For special dairy			
cattle and dairy			
products research ....	\$60,575:	\$72,400:	\$72,400 -
Penalty Mail Costs,			
Department of Agricul-			
ture (Allotment to			
Bureau of Dairy Industry)			
For cost of penalty			
mail pursuant to Sec-			
tion 2, Public Law 364,			
78th Congress .....	1,014:	1,200:	1,500
TOTAL, OBLIGATIONS UNDER			
SUPPLEMENTAL FUNDS ...	61,589:	73,600:	73,900





BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

(a) Field Crops

Objective: The broad objective of the research program on corn, cotton, wheat, alfalfa, sugar beets, tobacco, and other field crops, is to advance public and farm welfare, by developing information, methods, and materials to: (1) Increase efficiency and reduce costs of crop production; (2) insure ample and constant supplies of food and feed crops for the optimum nutrition of our people and their livestock; (3) insure supplies of fibers and other raw materials in the quantities and of the kinds needed for satisfactory industrial uses; and (4) increase farm income to encourage and support a high standard of living. More specific objectives are as follows:

- (a) To develop improved field crop varieties, adapted to different regions and soil types, resistant to disease and other hazards, high in yield and quality, and superior in handling, nutritional, or technological values.
- (b) To develop practical control methods for crop diseases.
- (c) To devise cultural practices giving optimum returns in crop yield and quality at a minimum cost.
- (d) To devise practical systems of culture, cropping, and chemical treatments for the control of weeds.

The Problem and its Significance: This appropriation provides for research on the principal farm crops grown by American farmers, including corn, cotton, hay, wheat, oats, tobacco, soybeans, sugar beets, and other field crops. These crops had a total farm value in 1945 of approximately \$11,100,000,000. These field crops provide the principal part of our food, and our food and pasture for livestock; our supply of fibers, oils, and other raw materials for industrial uses; and include as well the most important soil-improving and soil-conserving crops. The 1948 estimate for this appropriation is less than three hundredths of one percent of the farm value of those crops.

A continuing research program to improve the efficiency of our field crop production is essential to provide necessary information for re-adjustments which must be made in passing from emergency war and post-war production to a normal peacetime basis, and to protect the economic position of the American farmer in the years to follow. During the war technological advances developed by previous research contributed greatly to the tremendous wartime production of our farms. There are great opportunities to make further advances through research that will be equally important in helping farmers to meet the problems of peacetime cropping adjustments. Further progress in increasing efficiency and reducing costs of production is dependent on research.

For example, cotton before the war was our most important agricultural export. It produces the major portion of the income for more farm people than any other crop. Increasing competition from cotton production of foreign countries and from synthetic fibers is endangering the

position of the cotton farmer. The most logical way to meet this competition is to improve quality and reduce production costs through research on breeding, disease, and cultural problems. Results of our fiber quality research have given us a definite advantage in quality, but continued improvement is necessary if American cotton is to remain the best in the world. Similarly, the production of domestic sugar from sugarcane and sugar beets will face increasing competition from foreign sources as conditions again approach a world normal. Improved varieties higher in sugar content, more disease resistant, and adapted to machine methods of culture and harvest, as well as improved cultural, harvesting, and storage practices are necessary to reduce production costs and to maintain a sound domestic sugar production program which experience during both World War I and World War II has demonstrated is so necessary to our National welfare. Likewise the prosperity of the American tobacco grower depends to a large degree upon the maintenance of an adequate foreign market and the ability to meet increasing foreign competition. Such competition can be met most effectively if varieties and production practices that will insure maximum yields, lower production costs, and provide higher quality are developed through research. Diseases are a major problem and more than one disease has become prevalent in a single area. Combining resistance to several diseases into one variety of satisfactory yield and quality is infinitely more difficult than developing a variety resistant to a single disease but experience indicates that it can be done.

The increase in the annual farm value of field crops as a result of research under this subappropriation cannot be stated in dollars, but the following examples illustrate the potential value of continued research: An increase in average corn yields due principally to hybrid corn from 25.4 bushels per acre for the 1923-32 pre-drought years to a range from 31.0 to 35.2 bushels per acre during the 5-year period 1941 through 1945 (equivalent to an increase of over 3.4 billion extra bushels for the 5-year period); 550 to 600 million extra bushels of wheat during the period 1941 through 1944 from the development of improved varieties distributed since World War I, especially from the development of recent rust resistant varieties; and over \$8,500,000 added to growers' incomes in 1944 from the greater yields and higher quality of improved varieties of rice.

Need for research continues undiminished in all the major phases, including (1) breeding for improved quality, high yield, and resistance to disease, insects, and other hazards, (2) developing practical control methods for crop diseases, and (3) devising cultural practices which will give optimum returns in crop yield and quality at minimum cost.

#### 1. Breeding

Many improved varieties of various crops have been produced through breeding work, but only a beginning has been made toward the results which can and should be attained. It is not enough to develop a variety which is high in yield, or high in a particular quality, or resistant to a particular disease, insect, or other hazard. Varieties must be produced which



combine as many as possible of the desirable characteristics. The presence of one undesirable characteristic may be sufficient to prevent the adoption of a variety combining many desirable ones. Furthermore, varieties which are satisfactory when developed, may become unsatisfactory because of the occurrence of a new disease or a new strain of a common disease to which they do not have resistance. Continued improvement, therefore, is necessary. It is necessary to breed varieties best suited to particular regions and environmental conditions since individual varieties are not equally adapted to all areas and conditions. Varieties must also be developed to meet the needs of greater mechanization of crop production. New varieties must be thoroughly tested, sometimes over a period of years, before they can be released for general planting.

2. Disease and Weed Control

In addition to breeding for resistance to diseases, continuous research is needed on the control of diseases, weeds, and other hazards through the use of fungicides, herbicides, and other materials. Many new control agents which are constantly being developed need to be tested for effectiveness and possible dangers to plant growth. As with other living things, new strains of disease organisms are constantly developing through evolutionary processes or are accidentally introduced from foreign sources, and continuous search for new control methods is required.

3. Cultural Practices

Research to improve cultural practices as a means of bettering crop production and quality is essential. The development of (a) improved or new equipment for planting, cultivating, fertilizing, spraying and dusting, and harvesting crops, and (b) increased knowledge of soils, their management and fertilization, are continuously providing possibilities for improving crop production practices. Studies of their adaptation to particular crops are needed. The cultural requirements of new varieties, as for example seeding or planting rates, must be determined. The introduction of a new crop, such as soybeans, peanuts, etc., into a crop rotation frequently affects the other crops in the rotation. Investigations to develop proper cultural and production practices for the new crop rotation are required.

This research work must be continued and expanded if the food and other crop needs of our people are to be adequately supplied, and the American farmer is to compete successfully in world markets.

General Plan: The work consists primarily of field, greenhouse, and laboratory experiments in cooperation with State experiment stations, Federal agencies, farmers, crop-improvement associations, and other similar groups. Cooperative work is in progress with most of the States, and intensive studies are conducted at central points where special facilities are available for developing information on diseases and their control, resistance to cold and drought, and other factors important in breeding improved varieties. The operation of the research

programs is conducted on cereal crops at 40 locations, on cotton and other fiber crops at 32, on forage crops at 28, on rubber plants at 8, on sugar plants at 15, and on tobacco at 11 locations. Such widespread distribution is necessary because of the national or regional nature of the investigations.

Results of the work are made available to farmers through the State and Federal extension services, publications, the agricultural press, and correspondence in reply to direct inquiries. Every effort is being made to inform farmers and agricultural workers of the latest research developments. Technical information and assistance are furnished other agencies of the Department for use in developing production goals and similar programs. Arrangements are made, in cooperation with State and with other Federal agencies to insure adequate seed supplies of improved varieties, and to increase as rapidly as possible seed of new improved types.

#### Examples of Progress and Current Program:

##### Cereal Crops:

A new spring barley, named Bay, was released to growers in Michigan in 1945. Produced in cooperation with the Michigan Agricultural Experiment Station, it outyields Wisconsin Barbless, the commonly grown variety by more than 25 percent in unfavorable years. The new variety matures a little earlier and has a slightly stiffer straw than Wisconsin Barbless, characteristics which make it more desirable for use as a nurse crop, and it has similar acceptable malting characteristics.

A study of the barley varieties grown by farmers in the United States and Canada has been published in Technical Bulletin 907. It gives full information about the plant and grain characteristics of each variety, including their reaction to diseases, quality of grain, areas where adapted, and other information valuable to research and extension workers, teachers, farmers, grain inspectors, operators in the grain trade, maltsters, and others. More than 140 commercial varieties are described, 90 are spring and 50 are winter. Many varieties were found to have several synonyms. The information is based on approximately 53,000 observations recorded at 15 experiment stations in the United States and Canada.

Through the development of hybrid corn, another three-billion corn crop was produced in 1945 in spite of a wet spring, early frosts, and the smallest acreage harvested since 1942 (91.2 million acres). With large acreages of hybrid corn, the average corn yields for the United States for the 5-year period, 1941 through 1945, have ranged from 31.0 to 35.2 bushels per acre, whereas the 10-year average for the 1923-1932 pre-drought years was only 25.4 bushels per acre. The total increase in production for the 5-year period over that expected with a yield of 25.4 bushels per acre amounts to 3,432 million bushels, or 29.5 percent.



A new hybrid sweet corn, "Improved Golden Cross Bantam", developed cooperatively with the Indiana Agricultural Experiment Station, was released to growers in 1946. It is similar in ear-type to the original Golden Cross Bantam that was introduced to the trade in 1933 and is now the most widely grown yellow cannery corn. The new improved variety, however, has a few more rows of kernels, which is desired by the canners, is taller and more satisfactory to seed growers, and produces somewhat higher yields.

A cooperative project on breeding for resistance to the European corn borer has shown encouraging progress. One inbred line that was produced had a stalk with an extremely thick, tough rind and observations indicated that borers had attempted to gain entrance to the stalk at various points with little or no success. Further research is necessary.

New quick-maturing grain sorghum varieties, especially Early hegari and Bonita, recently developed in cooperation with the Texas Agricultural Experiment Station, were successfully used for late plantings in western Texas in 1945. Dry weather until mid-July prevented planting varieties usually grown. The quick-maturing Early hegari, developed and distributed primarily to meet such conditions, produced a crop despite the adverse season. About 30,000 acres of Early hegari were grown in one Texas county alone. Other counties had smaller acreages.

Increased distribution of recently developed disease-resistant oat varieties contributed greatly to the record oat crop production in 1945. This bumper crop of feed grain facilitated the diversion of wheat to the relief of famines in Europe and Asia. Clinton and Benton, new early varieties for the North Central and Northeastern regions, were increased to about 50,000 bushels of seed in 1945 and were distributed for further increase on select farms in 1946. In addition to being disease-resistant, these varieties have superior grain quality, making them a more valuable feed for domestic animals, are high yielding, and have a stiff straw which makes them almost ideal for combine harvesting. Lamont, a hardy new winter oat that outyields the standard Lee by about 10 bushels to the acre in the Piedmont section of North Carolina, is being released to growers.

Rice varieties distributed by the rice experiment stations were sown in 1945 on 69 percent of the United States rice acreage, whereas in 1934 they occupied only 27 percent of the total acreage. In 1945, based on O.P.A. ceiling prices, the price paid for the improved southern varieties, as compared with the old commercial varieties, Blue Rose and Early Prolific, added over  $8\frac{1}{2}$  million dollars to growers' incomes.

Improved wheat varieties, developed in cooperation with agricultural experiment stations, were planted on more than half the total area in the United States devoted to wheat, according to a survey of the crop grown in 1944. The development of improved varieties, distributed since World War I, has added from 550 to 600 million bushels to the Nation's wheat supply during the past 4 years. Much of this increased production is the result of the development of new rust resistant varieties.



A step in eliminating the source of stem-rust, which winters on susceptible wheat varieties in northern Mexico and Texas and in the spring produces spores which are carried northward and cause disastrous rust epidemics in northern wheat fields, was the establishment of the new Austin wheat in Central and South Texas. This variety, developed in cooperation with the Texas Agricultural Experiment Station, gives good yields and is resistant to stem and leaf rust. Austin has proven so popular that some 600,000 acres of it will be harvested in 1946, and being rust-resistant, it becomes a barrier to the northward invasion of these rusts. Cadet, distributed in 1946, is the newest rust-resistant wheat developed for the hard spring wheat region. This new beardless variety has outyielded other beardless varieties, is resistant to shattering, and has a strong straw. It has exceeded other commercial varieties in the average of properties which determine milling and baking quality.

In the western wheat region, a new variety, Orfed, developed in cooperation with the Washington Agricultural Experiment Station, is resistant to bunt, which is a most important problem of that region. It also has other superior characters, including good yield, high test weight, and resistance to shattering and lodging. It can be successfully grown in southeastern Washington and adjacent Idaho and Oregon both from fall and spring seeding.

Sufficient seed of Wasatch and Cache, two new hard red winter wheats bred for resistance to dwarf bunt was available in 1945 for planting almost the entire wheat acreage in the dwarf bunt infested areas of western Montana, Idaho, and Utah. Since the distribution of these two new varieties, and a third, Relief, the percentage of cars on the Ogden, Utah market grading smutty has decreased from 44 to 6 percent.

Strains of soft wheat, resistant to leaf rust, mosaic, and hessian fly, have been developed in the cooperative program in Indiana and are being tested for yield and quality. Some are very promising.

To aid in evaluating new varieties of wheat, a simple test which requires only 5 grams of flour has been developed for estimating the protein quality or bread baking capacity.

The control of weeds with 2,4-D, a growth regulating chemical or "plant hormone" developed during the war and found to have unusual killing action on plants, was further tested. Its value for killing most broad-leaved weeds in lawns seems to be well established. Unfortunately it does not kill weedy grasses, such as crab grass and quack grass, but it does kill clover in lawns, and unless care is used in spraying, adjacent ornamental plants may be killed. Spraying with 2,4-D has controlled certain weeds in sugarcane fields and eliminated at least two hoeings. It usually kills the tops and shallow roots of noxious perennial weeds such as bindweed and Canada thistle, but the deeper roots are not killed and eventually new shoots appear. Cultural and rotation practices necessary to supplement the 2,4-D sprays have not yet been worked out. The critical factor in the use of 2,4-D is not the concentration of the spray, but the quantity applied per unit of leaf surface.

### Cotton Investigations:

The one-variety cotton program is estimated to have increased growers' returns by \$62,000,000 in 1945. Whereas in 1944, 36% of the acreage and 39% of the crop were represented in the one-variety program, in 1945 these were increased to 40% and 45% respectively, and the grower members in the one-variety associations increased from 299,000 in 1944 to 319,000 in 1945. A survey made in 1945 revealed that 64% of the 7,061,000 acres in one-variety production in that year were planted to only four variety types. Until a few years ago, about 500 differently named sorts were being grown in the Cotton Belt. Thus substantial progress is being made in efforts to reduce the great multiplicity of varieties being grown and to obtain volume production of cotton of the same variety and character of staple in the commercial quantities that manufacturers require.

Fiber wall structure found to affect plied yarn strength. X-ray studies of cell-wall structure revealed that gain in plied yarn strength was associated with larger X-ray angles. It was also found that in the cord tests the performance of varieties is not necessarily related to fiber strength or to singles yarn strength. This suggests the need for developing varieties with large X-ray angles in relation to good fiber strength indexes. Further studies relating cell-wall structure to special uses of cotton fiber are needed.

Equipment is being developed for rapid fiber quality measurements. Yarn strength and yarn appearance can be quite accurately predicted from fiber measurements that are now rapidly made by the Pressley breaker, the fibrograph, and the Arealometer. The latter instrument, which is still in the experimental model stage, provides a rapid, and apparently a very useful measure of fiber fineness and may replace the tedious measurements now required. The development is especially beneficial to the cotton breeder who has large numbers of progenies to examine in the short time between harvest and planting season. Fiber tests are fully as important as yield and other agronomic measures, but have been much more expensive and tedious.

Cotton breeding investigations are being continued to attain disease resistance, especially resistance to angular leaf-spot, verticillium wilt, and fusarium wilt, combined with desirable characteristics of fiber quality and productivity. Studies are also being made to develop seed treatments for preventing seedling diseases and improving the handling quality of fuzzy or reginned seed to permit them to be readily hill-dropped to facilitate mechanized culture.

### Fiber Plants Other Than Cotton:

A new fiber flax variety, Cascade, developed in cooperation with the Oregon Agricultural Experiment Station, and superior to varieties now most commonly cultivated, was released for field production in 1945. Characteristics of the new variety are exceptionally high yield of straw and fiber, good percentage of fiber in straw, immunity to rust, resistance to wilt, and tall growth habit. Defects of lack of uniformity in height, and somewhat late maturity



are being corrected by further breeding. The flax industry in Oregon is seeking means of reducing production costs to meet expected postwar competition, and this new variety should be helpful.

Assistance is being given to the rehabilitation of the abaca industry in the Phillipine Islands, which prior to the war was our principal source of fiber for high-grade marine rope. Technical aid is also being given to the continued production of abaca in Central America and to the improvement in quality of Western Hemisphere abaca fiber. This source of fiber continues to be necessary to the American cordage industry, at least until the Phillipine abaca industry has been rehabilitated.

### Forage Crops:

Special emphasis has been placed on those lines of investigational work that have seemed to make possible the greatest contributions toward increasing the production of feed and seed to help meet demands for increased supplies of meat, dairy products, and wool and toward increasing the production of soybeans and other critical crops. The research objectives have included reductions in losses from drought, disease, cold, heat, and other hazards; increases in yields of forage and seed; improvements in the value of forage for livestock feed; and a greater and more successful use of legumes for winter cover crops.

Alfalfa silage and alfalfa hay preserved by barn curing has increased feed value over field cured alfalfa hay. This fact was determined by cooperative studies with the Bureau of Dairy Industry and the Grain Branch, Production and Marketing Administration. (For improvements in equipment and design of structures for mow-drying hay and forage crops, see discussion under "Utilization of Electric Power on Farms," under Agricultural Engineering). The studies showed results from different methods of preservation as follows:

Percent loss of

<u>Method of Preservation</u>	<u>Protein</u>	<u>Carotene</u>	<u>Dry Matter</u>
Silage	16	60	17
Barn-cured hay	21	88	21
Field-cured hay	30	96	27

The field cured hay was made during excellent haying weather. The barn-cured hay was partially cured in the field and the drying finished in the barn with a forced ventilating system. No great differences in labor costs were found between the three methods of preserving forage, but the forage preserved as silage produced 16 percent more milk of higher vitamin content per acre than the field cured hay, and the barn cured hay produced 9 percent more milk than the field cured hay.



Experimental alfalfa hybrids continue to show their superiority in forage and seed production over standard varieties. Through a cooperative testing program, new selections made in one state will be made available to other states, and strains which are adapted in the East will be tested for seed production and other characteristics in the West where the commercial seed crop is normally produced.

Red clover breeding experiments were continued in an effort to produce new varieties resistant to northern anthracnose, a disease causing premature reductions in stand with consequent reductions in yield and effective life of the planting. This disease was wide-spread in the Corn Belt and Lake states in 1945. In cooperation with the Wisconsin Agricultural Experiment Station, a successful method was developed for producing artificial epidemics of this disease in the greenhouse. Large numbers of plants can now be tested and resistant plants selected for use in breeding disease-resistant varieties.

New soybean varieties, including introductions, selections, and hybrid material, showed many promising strains suitable for forage, food, and industrial purposes, and adaptable to a wide range of soil and climatic conditions. Nearly 1800 introductions and selections from introductions and hybrid material were grown at Beltsville, Maryland in 1945. Of these, 7 were classified as very promising, 92 as promising, and 130 as above the average. The most promising strains were placed in extensive observation tests in 1946.

Soybean disease surveys show that some of the more serious diseases, such as brown-stem rot, bacterial pustule, downy mildew, etc., are increasing and causing serious crop losses. Present varieties have varying degrees of resistance to the different diseases. Work is in progress on the development, through selection and hybridization, of strains which are immune or highly resistant to the most serious diseases, and will also retain the superior qualities of high yield, high oil content, good quality, and lodging resistance.

Lupine plantings have increased to approximately 250,000 acres, principally in the Gulf Coast area, since the seed was first released about ten years ago. In that area lupines make a much heavier growth than other winter cover crops and are especially valuable for planting following peanuts. A selected non-alkaloid strain of yellow lupine that gives promise of being better suited to sandy soils than the blue lupine now commonly grown, is being tested and further increased.

The protein content of orchard grass when grown in association with Ladino clover at Beltsville, Maryland, was found on the first cutting to have increased approximately 24% as compared with growing the grass alone. On the second cutting the increase was 19%. This and other tests indicated the desirability of grass legume combinations, such as brome-alfalfa, orchard grass-ladino clover, etc., for high producing pasture mixtures, as well as for hay or silage.

The 1945 season was the 30th consecutive year of grazing management studies on native range land at Mandan, North Dakota. Gains of livestock were as high or higher in 1945 than in any previous year in spite of lower rainfall during the grazing season than during the last five years. The gain per steer varied from 262 pounds on heavy grazed pasture to 313 pounds on light grazed pasture. Two new grass varieties, developed in cooperation with the North Dakota Agricultural Experiment Station, were released to farmers in 1946. The first, Mandan wild rye, has proved to be superior in disease resistance, quality, and ability to withstand heavy continuous grazing. The second, Green Stipagrass, has characters of high yield, rapid recovery and ability to grow well in pasture mixtures.

With increased demand for new and improved strains of grasses for hay and pasture purposes, intensive studies are being made of problems relating to seed increase and to vegetative increase of species that do not produce seed.

#### Rubber Production, Breeding, and Disease Investigations:

A severe hurricane in 1945 did considerable damage to Hevea trees at Coconut Grove, Florida, setting back the cross breeding of high-yielding and disease-resistant trees at least a year. If the trees recover from the hurricane damage so as to produce flowers in 1947, cross-pollinations between high-yielding and disease-resistant clones will be initiated.

The selection, breeding, and testing of special clones of kok-saghyz and guayule continues actively. Through breeding and selection, an improved variety of kok-saghyz has been tested and found to be more vigorous and to have an appreciably higher rubber content than the Russian stocks received in 1942. Studies indicate that both root size and rubber content may be increased rapidly now that satisfactory parental types have been isolated. Improved strains have also been received from Russia to supplement the breeding program.

A number of strains of guayule having a higher rubber content and giving greater growth than the best commercial variety have been isolated. Selections from the breeding material developed under the Emergency Rubber Project at Salinas, California, have been moved to Sacaton, Arizona, where some of the breeding work will be continued with the limited funds available.

#### Sugar Crops:

Development of methods of reducing loss of sugar in stored beets. Harvested beets are stored up to approximately two months, in order to permit longer use of expensive processing equipment. As they are stored, sugar beets undergo small but steady losses in sugar content as the result of respiration. Considering the enormous quantities of roots that are stored, the total sugar loss is very large. It has long been known that respiration of sugar beets is accelerated by high temperatures. Investigations conducted in cooperation with the Bureau



of Agricultural and Industrial Chemistry have proved that these losses can be greatly reduced by cooling the sugar beets with forced ventilation of the storage piles with cold night air and by white-washing the surface of the piles to reduce heat absorption. Engineering details as to walled structures for sugar beet storage, ventilation ducts, blowers, etc. need to be worked out. The beet sugar industry, alert to the magnitude of storage losses, is instituting large scale tests to apply this important finding.

Planting-space studies to aid mechanized sugar beet culture. Efforts to mechanize sugar beet culture have been given new direction and impetus by the discovery that the decisive factor influencing yields is the number of properly spaced hills (of 1, 2, and occasionally 3 plants each) per acre and not some fixed number of plants per acre. Sheared sugar beet seed, although usually producing a single plant, may produce 20 percent or more doubles and occasionally three plants in a cluster. The evidence indicates, however, that if attention in mechanization is centered on securing hills as obtained from sheared seed, in proper number and pattern per acre, then yields will be maintained, since actual plant populations are secondary. Thin but adequate stands may be blocked by machine, or be blocked with a hand hoe, and the laborious finger work of thinning to single plants can be eliminated completely.

Continued progress in breeding better sugar beets has been made. A new variety, U.S. 215X216/3, which is still more highly resistant to leaf spot and has a higher sugar content than U. S. 215X216/2 or the original U.S. 215X216, has been developed for the eastern sugar beet districts. Production of seed will start in a small way in 1947. Progress is being made with the use of the male sterility factor to enforce hybridization among beet lines, and its use as a tool for breeding has become exceedingly important. It has been demonstrated that varieties resistant to Black Root can be bred, but the incorporation of such resistance with other desirable characters necessary for commercial production is still to be attained.

New sugarcane varieties for Louisiana and Florida. Two new and improved sugarcane varieties were released to growers in the fall of 1945, C.P. 36/105 primarily for culture in Louisiana, and C.P. 34/79 primarily for culture on muck soils in southern Florida. Both varieties are adapted to machine harvesting because of erect growth and resistance to lodging, and have exhibited very favorable germinating and ratooning qualities in the respective areas. C.P. 36/105 is resistant to red rot, root rot, and mosaic, in addition to giving yields of cane and sugar comparing favorably with those from the higher yielding varieties grown commercially in Louisiana. It is most suitable for mid-season to late harvesting. C.P. 34/79 is resistant to mosaic, red rot, and leaf spot diseases and gives yields of cane and sugar outstandingly above yields from other varieties grown on muck soils in southern Florida.



Two hundred and six new seedling varieties were selected in the fall of 1945 for agronomic evaluation because of their disease-resistance and other outstandingly favorable qualities as disclosed by initial studies. Selection of this unusually large number of promising varieties from thousands of seedlings under initial observation reflects the cumulative value of the breeding program and gives promise of finding better varieties for commercial growing. The testing of these 206 selected seedling varieties will be conducted cooperatively with the Louisiana Agricultural Experiment Station.

Sugar loss from inversion. Investigations of the loss of sugar from inversion of sucrose show that varieties differ in their resistance to such losses. C.P. 34/120, released in 1942, was found to be outstandingly resistant to inversion when windrowed for subsequent milling, an almost universal late-season practice in Louisiana. On the other hand, C.P. 28/19, C.P. 29/103, C.P. 29/320 and several other varieties should be milled promptly after harvest because of their lack of resistance to inversion and loss of sugar when stored in windrow.

Additional sorghum varieties obtained from Africa. As a result of a scientific mission to equatorial East Africa, made possible through cooperation of the South Coast Corporation and the American Sugar Cane League, seed of approximately 1600 varieties and strains of sorgo and sorghum were obtained in 1946 from Anglo-Egyptian Sudan, Kenya, Uganda, Tanganyika, Northern Rhodesia, and Nyasaland. The varieties, many of which are high-yielding types, are intended primarily as breeding stock for use in developing high-yielding and otherwise improved sugar sorghums adapted for domestic culture as a supplementary source of sugar or for replacement of high sugar but low-yielding sorgo varieties now grown for sirup production. The varieties from equatorial Africa supplement the high yielding varieties collected in Ethiopia during the winter of 1943-44. The latter have been crossed with domestic sorgo varieties and the resulting progenies indicate that it is possible to increase the yield in such combinations without sacrifice of quality. Although hybrid seedlings obtained from the crosses have not as yet reached a stage of development permitting extensive agronomic evaluation tests, initial observations show much promise for many of them.

#### Tobacco Investigations:

Investigations on "frenching" disease. A striking disease of tobacco which is commonly called "frenching" occurs widely and causes considerable losses to producers annually. The disease is characterized by a yellowing (reticulate chlorosis) of the bud leaves in the early stages and the development of a "witches-broom" condition in the later stages. The cause of the disease has not been determined but the typical symptoms have been duplicated to a high degree through the toxic action of isoleucine, a natural amino acid. Abnormalities very similar to those of the disease have been obtained on plants grown in soil and in solution cultures in the greenhouse, from the application of 1 to 10 mg., of isoleucine per seedling.

The abnormal growth of the tobacco plant appears to be due to the direct action of isoleucine on individual growing cells. Its action, however, may be alleviated, modified, or intensified by simultaneous additions of other amino acids. It is assumed that abnormal protein metabolism, leading to an accumulation of excess free isoleucine, causes the response known as frenching. The cause of this abnormal protein metabolism under field conditions where frenching has been observed remains to be determined.

Control of weeds in plant beds by chemical treatment. Chemical treatments with calcium cyanamide and urea for the control of weeds and soil-borne diseases in tobacco plant beds, as reported last year, are being used extensively on the lighter soils in the south-eastern tobacco areas. Occasional growers have reported failure of the treatment to control weeds. This is often the result of working the soil too deeply in the spring just before sowing the tobacco seed, or the use of the chemical treatment on heavier soils where such treatments are not effective and not recommended. Studies of weed control have demonstrated that the treatment is effective only in the first one or two inches of the soil surface. Three to four inches below the surface many weed seeds remain viable. The soil should be worked very thoroughly in the fall before and after applying the chemicals. In the spring, before sowing the seed, only the first one or two inches of the soil surface should be worked very lightly to avoid bringing up viable weed seeds from the deeper soil areas.

Progress in developing varieties resistant to root decay. Root decay is a serious problem throughout eastern North Carolina, South Carolina, and Georgia tobacco growing areas. The trouble is a combination of root knot (*heterodera marioni*) and nematode root rot (*Pratylenchus* sp.) and the two diseases often occur in the same field. The growth of affected plants is retarded and the leaves ripen prematurely. The research for resistance has resulted in the isolation of a strain, from the selection T.I.706, which is resistant to both diseases. This resistance has been consistent each year under the most severe field conditions in widely scattered areas. The full T.I.706 resistance has been recovered in the progeny of a cross with susceptible flue-cured tobacco and from the first and second backcrosses to the susceptible parent. By rigid selection, F<sub>4</sub> and F<sub>5</sub> generation lines have been obtained from the second back-cross that appear to be slightly more disease resistant than the original T.I.706. Some of these highly resistant lines possess much of the appearance and quality of flue-cured varieties now being grown commercially.

(b) Fruit, Vegetable and Specialty Crops

Objective: The broad objective of the research program on fruit, vegetable, nut, ornamental, drug and other specialty crops is to advance public and farm welfare by developing information, methods, and materials to: (1) increase efficiency and reduce costs of production; (2) insure ample and constant supplies of those crops essential to optimum nutrition of our people; and (3) increase farm income to encourage and support a high standard of living. More specific objectives are as follows:

(a) To develop and make available as rapidly as possible varieties of superior quality which are resistant to diseases and adverse climatic conditions.

(b) To develop more efficient production practices, including fertilization, cultivation, pruning, spraying, and harvesting, so as to obtain maximum production with minimum use of labor and materials.

(c) To develop methods for the effective control of diseases causing serious losses through the use of fungicides, herbicides, and other materials.

(d) To devise the most efficient and economical methods of packing, shipping, and storing fresh produce to provide for its delivery in prime condition to the ultimate consumer.

(e) To determine the best methods for producing drug, condiment, insecticide, tannin, and other specialty crops, to develop improved varieties, and to determine regions with suitable soil and climatic conditions for their production.

The Problem and its Significance: The fruit, vegetable, and specialty crops include the great health protectors in our diet as well as highly important staple food sources. Their importance in our economy is indicated by the following figures for the farm value of these crops in 1945, for major groupings:

Fruits .....	\$1,320,000,000
Truck crops (commercial only).....	816,000,000
Potatoes .....	608,000,000
Sweetpotatoes .....	137,000,000
Peanuts .....	171,000,000
Tree nuts .....	85,000,000
Peas and Beans (dried) .....	115,000,000
Hops .....	37,000,000

The more abundant production of such crops and their transportation and delivery to the consumer in better condition is essential not only to maintaining a satisfactory income for the farmer, but also to the health and economic welfare of our entire population. The large number of men rejected by Selective Service on physical grounds traceable to malnutrition is clear evidence that the nutrition of our people has been inadequate.



In turn, higher food consumption made possible by larger war period incomes has demonstrated that our population will consume a more adequate diet if available at prices they can afford. Food crops higher in nutritive value and lower in cost, resulting from crop improvement and more efficient methods of production, should contribute greatly to the health of the public.

Some of the major problems encountered in this research program include:

1. Breeding

Many excellent varieties of fruits and vegetables have been developed but the possibilities for further progress are unlimited. In many cases, varieties which do well in one region are not suitable for another. The breeding of varieties adapted to the different soils, regions, and climatic conditions is especially important. Improved harvesting and marketing methods also call for new and better varieties. Breeding of vegetables for disease resistance has produced excellent results, but since new diseases are occurring, and there is need for combining resistance to more than one disease, a continuing program is necessary.

The development of improved varieties through breeding and selection is a slow process, varying in degree with different plants. It is particularly slow with tree fruits which may require several years for the new varieties to grow, bear fruit, and receive adequate tests as to productiveness, quality, storage characteristics, etc. In general, however, the longer a breeding program operates, the greater are its cumulative effects since more and more varieties of known parentage and selected crosses can be developed and tested. The use of new breeding technics is increasing the possibilities for still further advancement.

2. Cultural and production practices

There is need for the development of more efficient production practices, including soil management, fertilization, cultivation, pruning, spraying or dusting, and harvesting. The development by agricultural engineers of new or improved equipment, and by soil scientists of increased knowledge of soils and soil management practices are constantly providing possibilities for improving cultural and production practices. Such new practices, however, may have pronounced effects on quality, storage, and handling characteristics, and these relationships must be investigated.

3. Disease control

In addition to breeding for disease resistance, additional research is needed on the control of diseases and other hazards through the use of fungicides and other materials. Many new control agents and methods and equipment for their application are being developed and need to be tested on particular crops for their effectiveness and limitations. New strains of disease organisms are constantly developing through evolutionary processes, or are accidentally introduced from foreign sources, and research for methods for their control is required.

4. Harvesting and marketing methods and control of market diseases  
New methods are being developed to control ripening processes, not only of fruits on the tree but also of fruits and vegetables after harvest; new packaging materials are being manufactured; improved and faster transportation, especially by air, is becoming available; improved methods for cooling and storing fruits and vegetables are possible; changing methods of marketing and distributing products to the consumer are developing. Such changes make still more important the need for further investigations on the harvesting, packing, handling, shipping, and storing of fruits and vegetables, and on the effect of such changes on the quality and condition of the produce, and on the market diseases which may develop.

The research programs of the Bureau provide leadership in problems of national and regional importance and facilitate the coordination of the research activities of state agricultural experiment stations and others. In some cases, as with plant explorations and introductions from foreign countries, transportation investigations, or variety determination and classification, the Bureau is the only suitable agency for conducting the work. Through the coordination of federal and state research on regional problems, better results are obtainable more rapidly and with less expenditures of federal and state funds.

General Plan: The work consists primarily of field, laboratory, and greenhouse experiments in cooperation with State agricultural experiment stations, other Federal agencies, and growers. Work is conducted in 32 states, with intensive studies at central points where special facilities are available for developing information on diseases and their control, resistance to cold and drought, and other factors important in breeding improved varieties.

Results of the work are made available to farmers through the State and Federal extension services, the agricultural press, publications, and correspondence in reply to direct inquiries. Every effort is being made to make available to farmers and agricultural workers helpful information on problems brought about by shortages of labor, fertilizers, seed, metallic fungicides, etc. Technical information and assistance are furnished other agencies of the Department for use in developing production goals, fertilizer allotments, and similar programs. Arrangements are made, in cooperation with State and other Federal agencies, to insure adequate supplies of seed or propagating stock of improved varieties, and to increase as rapidly as possible such materials for new improved types.

Examples of Progress and Current Program:

Deciduous Fruit Investigations:

In the search for more efficient fungicides to control orchard diseases, spraying experiments have shown that the organic compound ferric dimethylthiocarbamate (Fermate) controls the scab fungus on Anjou pears without reducing the fruit set. Mercuric triethanol ammonium lactate

offers promise of more efficient control of the apple scab fungus since it tends to reduce the number of secondary lesions and so checks spread after the fungus is established. Satisfactory control of the cherry leaf-spot fungus has been obtained in two seasons' tests with 2, 3-Dichloro -1, 4-Naphthaquinone (Phygon), but the fungicide cannot be recommended for fruit rot of pears since it causes severe injury to the fruit.

Further tests with 2,4-D (dichlorophenoxyacetic acid) as a preharvest spray for preventing apple-drop show that this chemical has a much greater intensity and duration of effect on Winesap and Stayman Winesap varieties than Naphthaleneacetic acid, the compound commonly used. 2,4-D was completely ineffective, however, on Oldenburg (Duchess), McIntosh, Delicious, Golden Delicious, and York Imperial varieties. The combining of the drop-prevention spray with other sprays required late in the season would reduce spraying costs and offers sufficient promise to warrant further study.

A new peach variety, which has been tested as No. 4-155 and named Southland, has been released for propagation by nurserymen. It is a yellow freestone of the same season as Eiley but has larger fruit and is a much better shipper. The new variety is particularly adapted to the southern edge of the peach belt.

A new variety of strawberry, which has been named Suwanee, has produced excellent yields in southern areas. It has an exceptionally high dessert quality, even under adverse weather conditions when most varieties have little flavor. It is not firm enough for general market purposes but is an excellent variety for home gardens in the southern states. Suwanee originated from a cross between Missionary and Howard 17, the same parentage as Blakemore. It begins to ripen a few days later than Blakemore and has a longer fruiting season.

#### Citrus, Avocado, and Other Subtropical Fruit Investigations:

Citrus breeding work has been greatly hampered because of an unusual characteristic of citrus seeds. The seeds of most varieties contain several embryo plants, only one of which is the result of fertilization from pollen. This one seedling is therefore the only true hybrid; the other seedlings do not differ from the mother plant. Citrus breeders have had the problem of determining which of the seedlings is of hybrid origin. A special chemical test has been developed by which the hybrid can be established with fair accuracy. By use of this test, checked by crosses made with the trifoliate orange, a species having distinctive leaves, it has been established that the Temple orange can be depended upon to produce only true hybrids when it is used as the female parent. This discovery will greatly facilitate the breeding work for improved varieties of oranges and related citrus fruits.

Poor fruit set in commercial date orchards is due in part to cool weather at the time of pollination, according to carefully checked pollination experiments during the past three years. The percentage of fruit set was found to be correlated with the number of degree-hours of heat above 60°F occurring in the seven-day period following pollination. This explains why certain early blooming varieties, which have a greater proportion of the



blooms pollinated during relatively cool weather, are apt to be less reliable producers than later-blooming varieties. Bagging the clusters of the early-blooming varieties has produced a greater fruit set, due to the higher temperatures within the bag.

#### Nut Investigations:

Annual crops of pecans may be expected with a fair degree of certainty if orchards are properly managed. A complete management program, based on the best known methods of pecan production, has been followed in two experiments, one extending for 8, and the other for 12 years. The stand of trees was properly thinned to do away with crowding; the trees were fertilized with a complete fertilizer, and rosette was controlled by applications of zinc sulfate; winter legume cover crops were grown; the soil was cultivated during the summer to keep grass and weeds under control; and the diseases and insects attacking the trees or nuts were controlled by sanitary measures and spraying. Since this program was started there has been no crop failure, and the average production over the 8 and 12-year periods is over 500 pounds of nuts per acre per year. Many large growers who have tried this pecan orchard management program on a limited scale are now using it on all of their orchards.

Investigations on pollination of pecans have shown that cross-pollination results in a much higher percentage of nuts reaching maturity and more large clusters which contain three or more nuts, than follows self-pollination. The percentage of well-filled nuts is also higher, so that yields of salable nuts are much greater in the cross-pollinated lots. Pollinating with a sister variety produces effects similar to self-pollinating, but to a somewhat lesser degree.

Young tung trees are stimulated by frequent and thorough cultivation, as demonstrated by experiments in Florida and Georgia. Unless cultivated frequently during the dry months of late spring, the trees seem to enter a state of rest which prevents them from resuming active growth when the summer rains begin. The ordinary practice of disking the orchard three or four times and hoeing around the young trees once or twice is not sufficient. Stirring the soil close to the trees seven extra times produced well-branched one-year trees 5 to 6 feet in height, whereas those under conventional culture were unsatisfactory unbranched whips about 3 feet high. The greatly increased growth fully justifies the cost of the additional tillage.

#### Vegetable Investigations:

First generation hybrid tomatoes from early-flowering and early-maturing Cheyenne inbred tomato strains outyielded standard varieties now grown in the Central Great Plains by as much as eighty-five percent, as shown by field tests. These hybrid lines are being selected and crossed with commercial varieties to improve fruit quality. Further testing will be necessary to develop desirable parents for the production of hybrids suitable for commercial production in the Great Plains.

Breeding disease-resistant tomatoes aided by colchicine treatment. Progress in incorporating disease resistance or high vitamin C content from the wild Peruvian tomato into the commercial tomato was previously blocked by failure to obtain interspecies hybrids readily. Investigators at the Cheyenne Horticultural Field Station have overcome this obstacle by utilizing colchicine-induced tetraploids of commercial tomato varieties in making crosses with strains of the Peruvian species that fail to yield hybrids when crossed with normal diploid tomato varieties. This very effective means of obtaining large numbers of first-generation hybrids between the two tomato species will greatly facilitate the tomato breeding program.

New hybrid squash varieties developed. The colchicine treatment has also been found to aid in the breeding of new squash varieties. First-generation hybrids which were self-sterile and exhibited very low fertility in backcrosses to the parent species have been made fertile by doubling the chromosome complement by colchicine treatment. The resulting amphidiploid lines breed true and are self-fertile but are cross-sterile with the parent species. They are essentially new species of squash. Several lines now under test are more vigorous than their parent species and have fruit flesh of the type desired for baking and for increasing the bulk and quality of canned pumpkin. In baking tests some of the new lines were superior to Golden Hubbard which was used as a standard. These lines are being tested to see whether they carry resistance to squash bugs.

A new onion, Yellow Bermuda 986, introduced cooperatively in 1945 with the Texas and California Agricultural Experiment Stations, was widely tested and its performance has been highly satisfactory. It is 10 days to 2 weeks earlier than the regular Yellow Bermuda, the bulb is somewhat deeper, and it has yielded on an average about 75 bushels per acre more than the older strains. It bolts less readily and is practically free of doubles, splits, and off-colors. Methods have been developed for the domestic production of high quality Yellow Bermuda onion seed at low cost. Heretofore, most of the Yellow Bermuda seed used in this country has been obtained from the Canary Islands, but recently the quality of the seed from that source has deteriorated. Stock bulbs which have the desired characteristics are selected in the extreme South in late March or early April. These are shipped North and planted about July 1 for vegetative increase. The "increase bulbs" mature in early September, are cured and stored during the winter, and then planted the following spring for production of stock seed. The stock seed matures in time to plant in the Imperial Valley by September 20 and from this planting a commercial seed crop is harvested the following June or July, thereby saving a year as compared with production in the North. By this method, 4 pounds of stock seed of Yellow Bermuda 986 that was planted in the Imperial Valley in September, 1944 produced 930 pounds of seed the following summer, a 232-fold increase. The improved variety and the seed production procedure will markedly increase the efficiency and dependability of Yellow Bermuda onion production.



The new Pinto No. 5 and Pinto No. 14 field beans yielded 1000 to 1200 pounds more beans per acre than rust-susceptible commercial varieties in field tests in northeastern Colorado, where rust was widespread in 1945. These new varieties also outyielded the commercial types in tests where rust was not present. The lines are resistant to 22 out of 24 known forms of bean rust and are of acceptable commercial type. Seed is being increased in cooperation with the Colorado Agricultural Experiment Station. Sulfur dusting to control bean rust, an operation that costs from \$1.50 to \$4.50 per acre, will be unnecessary when seed of the new rust resistant lines is made available.

A new cabbage variety, Improved Wisconsin Ballhead, was released to commercial seedsmen in the Spring of 1946 and should be available to gardeners and truck-crop growers for 1948 planting. This new variety, produced cooperatively with the Wisconsin Agricultural Experiment Station, possesses higher resistance to yellows than Wisconsin Ballhead, one of its parents, has a later and therefore a more desirable maturity, produces less leaves and more head weight per acre, and has a smaller core, and a better color of head.

Cabbage seed yields were doubled in 1945 in the Mt. Vernon, Washington, area of production through the control of virus diseases as a result of cooperative work of Washington State agricultural agencies and the U. S. Department of Agriculture. A survey made three years ago showed cabbage virus diseases, commonly called mosaics, to be a major factor in causing low yields of seed. Growers were instructed that the disease was spread by plant lice from old diseased seed fields to the new plant beds of young seedlings, and to prevent this spread it would be necessary to establish the plant beds in isolated locations where there were no diseased seed fields nearby. This recommendation was widely followed for the 1945 crop, but just enough plants were grown in close proximity to old seed fields to show that these diseased plants produced only about half as much seed as plants that were grown in the isolated locations.

Tests with DDT. Greenhouse tests to determine the toxic effects on plants of DDT and related insecticides indicate that growth of certain crops are hindered when DDT is applied at a rate of 25 pounds per acre to soils with a low humus or organic matter content. Crook-neck squash, cucumber, cantaloup, spinach, beet, onion, snap bean, lima bean, garden peas, tomato and carrot plants were affected at this rate of treatment. The application of 100 pounds per acre depressed the growth of corn, broccoli, cabbage and turnip. However, on rich soil, high in organic matter and colloids, the same applications of DDT had no effect on any of these crops. Four hundred pounds of DDT per acre on such soils depressed growth of all crops shortly after application but the effect had disappeared after 6 months time. It is presumed that organic matter absorbs or inactivates large amounts of DDT and thereby prevents injury. On mineral soils the DDT tends to accumulate and the toxicity increases with time.



### Potato Investigations:

Three new scab-resistant potato varieties, Ontario, Seneca, and Cayuga have recently been released in cooperation with the Cornell Experiment Station. In addition to their scab resistance all three show some resistance to late blight and fusarium wilt.

Breeding for resistance to ring rot disease has been in progress for 7 years. As a result of this work, the Teton variety has been released in cooperation with the Wyoming Agricultural Experiment Station. It has shown a high degree of resistance to ring rot in severe tests in Wyoming and Maine and should be valuable for the districts where that disease is a serious menace to potato production.

### Ornamental Plant Investigations:

Fusarium corn rot of gladiolas is greatly increased where phosphate is low and nitrogen is high as shown by nutrient culture tests. The rot is minimized by increasing phosphate levels or decreasing nitrogen levels. Nitrogen from tankage applied to field plantings increases fusarium rot and depresses flower and corn yields as compared with the application of inorganic nitrogen fertilizers.

Fifteen tetraploid Easter lily clones have been developed by colchicine treatment. All the tetraploids bear larger flowers with thicker petals than those on the diploids. One new tetraploid reaches a height of 3 to 4 feet and is an excellent type for cut lilies. Another flowers on a stem 15 to 24 inches tall, making an ideal pot lily for Easter. As soon as these tetraploid lilies are available in quantity they will undoubtedly replace others now being used. Six seedling clones of Speciosum lilies have been developed to increase the spread of the flowering season for this species. As a rule this lily is in bloom for about 10 days. These new clones have different blooming dates, giving flowers in succession over a period of 5 to 6 weeks.

### Methods of Handling, Transportation and Storage, and Market Diseases of Fruits, Vegetables, and Flowers:

A more effective control of apple scald has been developed as a result of research during the past 2 years under this appropriation and the Special Research Fund. It consists of the application of Naphthalene-acetic acid in a solution of lanolin to the fruit as it passes through the sizing and packing machines. Only a small quantity of the material is needed and the cost is lower than that for the oiled paper now commonly used. Oiled wrappers or shredded oiled paper have usually given satisfactory commercial results but have not always been effective on bad scalding varieties like the Harbinger Black Twig. Scald-free apples average 25 cents per bushel more in their selling price, which means a potential gain of about a million dollars annually for the nation's apple crop. Application is being made for a public service patent for the new scald-prevention treatment.

Airborne shipments of tomato plants from Tifton, Georgia to Bowling, Green, Ohio were <sup>studied</sup> to determine the condition of the plants as affected by altitude, speed of delivery, and method of packing. The results showed that the plants can be shipped satisfactorily by air without special packing and that they can be tied in bundles and placed in burlap bags just as they are now taken from the fields to the packing houses. The shipping time required was only 5 to 6 hours as compared with 30 to 36 hours by rail express. The faster shipments will insure delivery of plants with less deterioration in vitality and will enable growers to obtain delivery when weather conditions are favorable for planting. Shipments now often arrive during cold rainy spells when the plants cannot be set out with the result that there may be a complete loss after receipt. The saving in packaging costs did not offset the higher cost of air transportation but if air transportation costs are reduced sufficiently, this method of shipping will undoubtedly be used extensively.

Top-icing of cantaloup shipments from California to eastern markets has proved to be a practical and effective way of shipping vine-ripened melons. As soon as the melons are loaded, about 10,000 pounds of snow ice are blown over the top of the load and the car is promptly started for its destination. The melons are cooled more quickly by contact with the melting ice and ice water than by conventional methods of precooling, thus arresting ripening processes and also mold and decay. By this practice riper melons of better quality can be shipped with assurance of remaining in satisfactory condition through ordinary trade channels. The cost for the extra ice used should be more than offset by the increased price obtainable for melons in prime condition.

Preliminary investigations in the New York City area on the pre-packaging of fresh produce in consumer units, have shown that moisture-proof and gas-permeable characteristics of the packaging materials are important factors in the maintenance of quality of the produce. The use of a wrapping film that permits carbon dioxide to accumulate resulted in the failure of tomatoes to color normally and impaired the flavor of broccoli. When gas-permeable films were used these effects were not noted but shrinkage in weight was increased. Fungus diseases and bacterial soft rot were increased when moisture-proof wrappings were used. Certain types of spoilage and deterioration will be increased by prepackaging and it is imperative that requirements of individual commodities be determined through further studies to prevent the incurring of heavy losses by ill-advised practices.

The watery soft rot disease of string beans has appeared in alarming proportions in most of the south Florida winter production section and has caused heavy losses both in the field and in the harvested crop enroute to market. Tests conducted during the past 2 years have demonstrated that precooling the beans to a temperature of 40°F will control the development and spread of the disease during the shipment from Florida to northern markets. The rapid cooling prevents the development of the disease. This method is the only effective way that has been found to prevent heavy losses of the beans during transit.

Reduction of chilling injury in shipments of sweetpotatoes possible.

Test shipments of sweetpotatoes from Louisiana to northern markets made during the winter proved that existing rules for operating car vents and heater service to maintain the load temperature at a minimum not below 45°F are inadequate and unsafe. Chilling injury, exhibited by internal discoloration of the roots and impaired flavor and appearance of the cooked sweetpotatoes, was found in lots where the temperature dropped to 45° during transit. Storage tests have shown that 55°F is optimum and that more than short exposure to a temperature of 50° is injurious. These results indicate that railroad rules should be modified to provide protection of sweetpotato shipments by maintaining transit temperatures not lower than 55°, instead of 45°.

Special ripening method salvages large quantity of unpollinated dates.

Investigations conducted in the Coachella Valley, California, showed that it is possible to salvage unpollinated dates which constituted approximately 6 million pounds of the 1945 crop. These dates are very slow to ripen, if they ripen at all, and ordinarily most of them are not harvested. It was found that unpollinated dates could be made to mature and ripen by holding the dates in a moist atmosphere at a temperature of 125° to 135°F for about 4 days, after which time they became soft and sweet. The quality depended on their stage of maturity at time of harvest, the longer they were left before picking the better the quality attained by the artificial ripening. These ripened unpollinated dates were seedless and somewhat smaller in size than normal fruit, but they proved highly satisfactory for use in confections. The special methods of ripening and handling the unpollinated dates have been adopted by the industry and made possible the salvaging of a large tonnage in 1945 that would otherwise have been largely lost.

Drug, Oil, Insecticide, Tannin, Flavoring, and Special Plant Investigations:

An exceptionally high yield of tannin is produced by a new strain of sumac which has been developed. The new strain, selected from the native dwarf sumac, produces leaves with an average tannin content of about 35 percent when grown under cultivation, as compared with the 25 percent generally found in the leaves collected commercially from wild plants. The product is similar in quality to imported materials sometimes used for tanning light leathers. The improved selection has possibilities as a crop on hilly lands subject to erosion in the eastern part of the United States.

Hop Production, Breeding, Disease, and Quality Investigations:

Hop transportation and storage investigations. Considerable space is required for transporting hops by rail or ship and methods for reducing their bulk are being investigated. Pulverization and subsequent compression reduces volume but was found to accelerate the loss of soft resins in both open and cold storage. The rate of loss tended to increase with finer pulverization. Extraction of the resins at the source of production offers some possibility and eight commercially available



solvents were found to extract all of the desired constituents of the hops and provide extracts of the characteristic test and aroma when the solvent was completely removed. The practical application of the extraction procedure will depend upon reductions in the cost of the extraction processes.

### (c) Forest diseases

Objective: The broad objective of the work in forest diseases is to increase the value of forest and shade trees, to enhance the returns from timber and to preserve forest products by reducing the occurrence of diseases and decay, or by the development of management practices which reduce the detrimental effects of diseases. Immediate objectives include development of (1) forest-management practices, including disease control, to avoid losses from heart rot, root rots, little leaf and other diseases; (2) improved practices which will prevent decay in lumber and wood products in all their varied uses; (3) improved methods of inspection and grading to avoid deteriorated wood without needless rejection of valuable material; (4) methods of control of diseases of shade, ornamental, and forest nursery trees; and (5) tree varieties resistant to specific diseases.

Responsibility: Governmental responsibility for conducting investigations of diseases of trees and forest products is centralized under this appropriation, thereby avoiding costly duplication of work. Accordingly, the Forest Service and the National Park Service depend heavily on the Bureau for the development of methods for avoiding or controlling diseases on the millions of acres of National Forests and National Parks. The Soil Conservation Service depends on it for investigational work on forest tree diseases in nurseries and erosion control plantings. State agencies, municipalities, and private owners also depend upon the Bureau for assistance in the control of diseases of shade trees, forests and forest products. This centralization of work carries with it the obligation to maintain a research program which is coordinate with the needs of the other agencies.

The Problem and its Significance: Our forests annually produce new products valued at over 2½ billion dollars. Losses from disease constitute one of the largest drains on forest resources and approach or exceed the losses from fire. Heart rots alone make it necessary to cull nearly 11 percent of the gross volume of the annual saw-timber cut. Diseases not only destroy wood but increase logging costs and labor requirements because many trees when cut are found to have too little sound wood to cover the expense of felling and bucking.

It is important not only to combat disease but also to learn how to better estimate the damage already done. Recent trends in forestry intensify these needs. Selective logging is being substituted for clear cutting in many areas, but for only a relatively few timber species have methods been developed for determining which trees will deteriorate from decay and which can be safely left standing until a later cutting, or how much the wounds made during selective logging increase the decay hazard to the trees left standing. The development of satisfactory second-growth stands may fail if disease aspects are neglected. Forest and erosion-control plantings are hampered by diseases that dwarf or kill young trees. Disease epidemics destroy shade and ornamental trees, leave city streets without trees, and reduce property values. Much of the lumber now

being sold has a high proportion of sapwood, which is particularly susceptible to decay. New problems have arisen in the protection of lumber and wood products for buildings, boats, containers, and other uses. Production of rosin and turpentine is a major industry in the South and new methods for artificially stimulating rosin flow must be investigated and means devised to avoid or control diseases that affect the freshly cut faces of trees.

General Plan: This work is directed to the solution of current disease problems in connection with timber management, wood utilization, and destructive forest and shade tree disease epidemics. Laboratory and controlled field tests are conducted in cooperation with the Forest Service, the Soil Conservation Service, the Bureau of Entomology and Plant Quarantine, the National Park Service, State experiment stations, municipalities, and nurserymen. Field workers are stationed at 13 locations, mostly at Forest Service headquarters.

Examples of Progress and Current Program:

Control of decay in exterior woodwork of buildings such as porches, steps, and railings due to rain seepage at joints has been developed. Such decay is increasing because of the higher percentage of non-durable sapwood in present day general construction lumber. Outdoor tests showed that considerable protection can be afforded by designing joints so that rain water is diverted past the joint. In cases where it is not feasible to design joints that exclude water seepage the service life of southern pine sapwood exposed to rain can be materially increased by brushing or dipping in oil-soluble chemicals. Pentachlorophenol 5 percent, phenyl mercury oleate 0.2 percent, and copper naphthenate 18 percent were successfully used. Application can be made on the job, the cost is relatively low, and a paintable surface is left. These simple protective methods offer promise of extending considerably the life of non-durable woods when used off the ground, but are not suitable for use on wood in contact with the soil or other sources of continuous moisture.

White pine blister rust investigations. Preliminary tests have been made in California to develop visual criteria by which, on Ribes leaves, white pine blister rust can be distinguished from the relatively harmless pinyon pine rust. Determinations made by stains agreed with determinations by the visual method for most of the specimens examined but further experience is needed before the visual method can be recommended for use by blister rust scouts in the field. The results of natural and artificial inoculation of white pine in a Wisconsin nursery continue to strengthen the belief that it should be possible to develop and establish resistant types of white pine.

Preventing decay in green lumber. The chlorophenates and organic mercury salts previously developed for the control of stain and mold fungi on lumber during the air-seasoning period, also have been



found effective against decay fungi. This was true for lumber not only open-piled for seasoning, but also close-piled in a green condition before being seasoned. Mixtures containing both these types of chemicals with relatively large amounts of borax, were found particularly effective in preventing decay. More general use of these treatments should do much to reduce decay occurrence in lumber during the readjustment period when urgent demands lead to the shipment of large amounts of lumber in the green condition.

Salvaging logs from diseased fir trees. White and California red firs bearing conks (fruiting bodies) of the stringy brown rot fungus may be partly sound, despite the long-held belief by lumbermen and foresters that such trees are completely worthless because of heart rot. On two National Forests in California it was found that trees with small or medium sized conks located either low or very high on the trunks of firs might contain as many as five sound logs which could be utilized for lumber. Common practice in the past has been to leave all conky trees in the woods, but with the present heavy demand for lumber this wasteful practice is no longer justifiable. A short method for judging how much sound material a fir with conks may contain has been developed for the use of timber markers in selecting trees for cutting. The investigation showed that on trees bearing conks under .7 of a foot in greatest dimension, one and one-half 16-foot logs should be allowed for decay above the highest and below the lowest conks. On trees bearing conks more than .7 of a foot in greatest dimension two logs 16 feet long above the highest and below the lowest conks should be allowed for decay. Use of this simple formula will salvage much fir timber that otherwise would be left in the woods.

Control of decay in sprout oaks. Studies started some years ago provide clear evidence that measures to minimize decay in sprout oak stands should be taken before the trees are 15 years old. Removal of sprouts which leave pruning wounds over  $1\frac{1}{2}$  inches wide will often lead to decay, while smaller wounds are usually safe from decay. The studies also showed that sprouts which arose highest on the parent stumps and which are therefore most likely to develop butt rot, continue to dominate the stand. Proper thinning and pruning of sprout oaks when under 15 years old will both eliminate high-origin sprouts and avoid large thinning and pruning wounds.

Cause of burn blight of pine determined. The cause of an extensive dying of jack pine and of red pine in Wisconsin has been determined. Carefully controlled tests have shown that a fungus, Chilonectria cucurbitula, is the cause of the disease. The disease, called burn blight, was first recognized in 1941 and now extends over 6,000 acres. Trees die from the top downward. The fungus invades the trees during the summer largely through injuries made by the Saratoga spittle insect but also through other types of wounds. The following season the infected trees begin to wilt and die. The results of the study suggest that the most promising preventive is through control of the spittle insect.

Decay studies of western hemlock. In the Pacific Northwest the fungus, Fomes annosus, was found to be the most prevalent wound parasite of western hemlock. The volume of decay produced by it exceeded that produced by all other fungi combined, and created an estimated loss of 6.5 percent in the merchantable volume of western hemlock in the area studied. The occurrence of the destructive Fomes annosus in wounds on trunks and in tops of trees emphasizes the importance of avoiding, as far as possible, injuries to the residual stand in selective cutting in western hemlock.

Propagation of elms resistant to Dutch elm disease. The elm, Christine Buisman, resistant to Dutch elm disease is being released to several Arboreta and Experiment Stations. A second American elm resistant to the disease has been discovered and is being propagated. Among a lot of 600 hybrid seedlings only 35 developed disease when inoculated for the first time this year. The resistant hybrid trees have been propagated by budding to American elm stock to determine if they are compatible with American elm and if they will retain their resistance on seedling roots of unknown reaction to Dutch elm disease.

Methods of controlling Dutch elm disease are being studied intensively in control areas at Princeton and Morristown, New Jersey. Removal of bark beetle infested trees, diseased trees, and pruning of diseased trees where possible, apparently are effective in retarding spread of the disease. In some similar areas where no such sanitation program has been conducted in recent years the disease is spreading rapidly and is again approaching epidemic proportions.

Control of phloem necrosis of elm. Phloem necrosis, a virus disease of American elm, continued to spread and is now found as far west as Manhattan, Kansas and as far south as Georgia. First year results of spraying tests at Columbus, Ohio and Kansas City, Missouri were encouraging but not conclusive. At Marietta, Ohio, removal of diseased trees is being tested as a control measure, and results to date indicate that this method holds the disease in check.

Although intensive studies are being made to discover how the disease spreads, no positive evidence has been obtained. Tests have been started to determine if the disease can be transmitted through dodder. A species of dodder that will grow on elm has been discovered.

Young American elms, selected for resistance to the disease, have been sent to Missouri, Kansas, and Oklahoma, for field trial. Elms resistant to Dutch elm disease have been planted in our nursery at Columbus, Ohio for testing for resistance to phloem necrosis. Extensive trials are being made of methods of propagating elms by cuttings to provide a means of increasing quickly stocks of elm resistant to phloem necrosis and Dutch elm disease.

(d) Soils, Fertilizers and Irrigation

Objective: The broad objective of the research program on soils, fertilizers, and irrigation is to advance public and farm welfare through developing information, methods, and materials to: (1) maintain and rebuild the nation's vital soil resources; (2) maintain and increase fertility while producing crops on the most economical sustained basis; (3) serve in helping to effect adjustments in land use to meet changes in national requirements; (4) aid in insuring a more stabilized and profitable agriculture in dry-land and irrigated regions; and (5) increase farm income to encourage and support a high standard of living. More specific objectives are as follows:

- (a) To develop for all regions soil-management methods, including fertilization, liming, crop rotations, tillage practices, and other means of improving soils to maintain maximum economical production on a permanent basis.
- (b) To develop improved soil-management and crop-production practices that will make possible the most efficient use of limited rainfall on different soil types in the Great Plains and other semiarid regions.
- (c) To devise effective irrigation and drainage methods and practices to maintain production, and determine corrective measures for injurious salt concentrations in soils and in irrigation and drainage waters.
- (d) To develop improved and cheaper fertilizers and more effective methods of use.
- (e) To classify soils in a national system, determining their potential productivity under adapted cropping and improved management, and mapping their distribution for use in applying improved soil management and land use on individual farms.

The Problem and its Significance: The basic problem in soil management is to maintain and improve soil fertility under cropping systems that are profitable and permanent for the wide range of soil types and climatic conditions in the United States. Widespread deterioration in the inherent productivity of American soils has offset in considerable measure the beneficial effects on crop yields that should have accrued from great improvement in crop varieties, the use of fertilizers, land drainage and more efficient cultural practices. This deterioration is occurring even on the best level lands where erosion is insignificant, although, of course, erosion has speeded the process greatly in many areas. Often erosion does not begin until the protective vegetative cover has been starved out by soil depletion.



Results of studies for a 31-year period by the Ohio Agricultural Experiment Station on Wooster silt loam soil show that a good management system yielded annual net returns of \$30 per acre and a poor system only \$7 per acre. Furthermore, soil productivity in the poor system is still declining at a rate estimated at 10 percent in 10 years, whereas soil productivity in the good system is being steadily increased. This illustrates what is happening to soils elsewhere in the nation under poor or indifferent soil management, and the possibilities for developing effective management practices. Proved methods of good soil management have been worked out for relatively few soils, and in most areas information is needed on the effects of present practices and what changes should be made.

It is estimated that approximately \$500,000,000 annually is spent in the United States for fertilizers, and approximately \$40,000,000 for liming materials. In addition, farmers apply manure, grow crops, and adopt cultural practices in order to improve their soil, all of which represents many more millions of dollars of labor and farm operating costs. Such large expenditures, represented either by cash outlay or by labor, indicate the great need for research which will direct fertilizer application and soil management practices toward their most effective use.

Postwar conditions have produced many problems relating to fertilizers and their use. Imports of certain fertilizer materials have been stopped. In the face of a world shortage of fertilizers and an increased world demand, we are exporting more than normal amounts. The war produced important changes in fertilizer technology as a result of the introduction of new fertilizer materials and caused a great increase in capacity for nitrogen fixation and sulfuric acid production. One of the important problems is the effective incorporation in our civilian economy of war plants suitable for the production of fertilizer materials. This involves integration with the conservation of our fertilizer mineral resources and a sound soil management and use program.

Problems which require a concerted attack include, among others:

Soil-management practices to improve soils and maintain productivity in all parts of the country, involving rotations, cover crops, green manures, and the use of soil amendments and fertilizers as related to different crops grown on different soil types; soil-fertilizer relationships, including methods to increase the availability of phosphate and potash fertilizers in certain soils; the development and maintenance of desirable soil tilth so essential in economic crop production and in the maximum conservation of soils; soil-management and fertilizer practices necessary to produce profitable crops under irrigation and on dry lands on a sustained basis; development of new fertilizer materials, fertilizer combinations, methods of manufacture, and testing the properties and values of fertilizers in order to reduce farm costs of fertilizers; classification and mapping of soils to provide information on the soils of individual farms which can be used to translate soil-management practices, fertilizer needs, and crop adaptation into the operations of each farm.

General Plan: Investigations relating to soil management and fertilization for crop production are being closely correlated with the work of State agricultural experiment stations. This is also true of the work with fertilizers, where, as a new fertilizer is developed, it is tested at several State stations, as well as at the Bureau's station at Beltsville, Maryland. The field investigational work relating to soil improvement and management is conducted at 35 locations, principally in the dry-land and irrigated sections. These include 14 locations at which the stations are owned and operated by the Bureau. They provide field facilities for all agricultural research; not only for the Bureau, but also for other bureaus of the Agricultural Research Administration, other agencies of the Department, and agencies outside of the Department. The operation of these stations, therefore, is important not only to this, but also to other agencies.

Soil management research in Humid Region is conducted in cooperation with one New England and five states of the Southeast. In New England emphasis is placed on soil management and fertilizer use for the commercial production of potatoes. In the Southeast the investigations are directed to the production of feed crops in a better balanced farming system including livestock.

Cooperative dry-land management investigations are conducted in the Great Plains and semi-arid regions of the West at 10 field stations maintained by this Bureau, and at 10 substations of State agricultural experiment stations. At these stations facilities are provided also for work cooperative with various divisions of the Bureau, such as Fruit and Vegetable Crops and Diseases, Cereal Crops and Diseases, and Forage Crops and Diseases; with other agencies of the Department, such as the Soil Conservation Service; and with the State agricultural experiment stations of the several States.

Irrigation-practice, drainage, and salinity-control investigations are conducted primarily at 6 field stations maintained by the Bureau, and are supplemented by necessary laboratory experiments. These field stations are located on Federal reclamation projects and the facilities available are used for cooperative investigations by other divisions of the Bureau of Plant Industry, Soils, and Agricultural Engineering, by the Bureaus of Animal and Dairy Industry, and by the several State experiment stations. The use of land and of irrigation water has been provided by the Bureau of Reclamation, and this agency also has contributed some buildings and special aid in land leveling and ditch construction. Cooperative investigations are conducted also at a State Branch Experiment Station at Prosser, Washington. Research covering field studies of crop adaptation, soil management, irrigation practices, soil-water relations, and plant disease and nematode control is being conducted at Bard, California, Hermiston, Oregon, Prosser, Washington, and Yuma, Arizona, to provide information needed in the development of the newly irrigated lands particularly in the Lower Colorado and Columbia Basin areas. These stations work cooperatively with the Salinity Laboratory, Riverside, California (operated with Special Research Funds) on investigations of salt constituents of irrigation and drainage water.



Basic investigations in soil plant relationships are conducted in support of the soil management investigations. They include fundamental studies on the chemistry of phosphates, potash, lime, minor elements and organic matter in soils and their relation to the nutrition of crops. The microbiological investigations include work on legume inoculating organisms and the rate of decomposition of various organic insecticides and weed killers in the soil.

Fertilizer and lime investigations include studies on the production, technology, and efficiency of fertilizer and liming materials and mixed fertilizers. Rapid advances in technology of mixed fertilizers have introduced many problems and increased the volume of research directed to assist farmer cooperatives and other manufacturers of mixed fertilizers. Analytical procedures for fertilizer analysis and control receive continuing review and research.

Studies on domestic and world resources, production, trade, and consumption of fertilizers and liming materials, including minor elements, are conducted in cooperation with State and Federal agencies. This includes studies in cooperation with other agencies of the factors influencing trends in fertilizer consumption in different parts of the country and the effect of fertilizer consumption on the maintenance of soil fertility.

Soil surveys are conducted cooperatively with appropriate State agencies, especially the State agricultural experiment stations, and with the Soil Conservation Service, the Tennessee Valley Authority, and other Federal agencies. In the fiscal year 1947, all field work of the Soil Surveys is conducted cooperatively with State soil survey organizations.

Scientists of the Bureau also cooperate with other public agencies in developing agricultural and land programs that involve needs for a knowledge of soil and for the interpretation of soil maps and other soil research. These cooperating agencies include the Bureau of Agricultural Economics, the Farm Credit Administration, the Soil Conservation Service, the Farmers' Home Administration, the Tennessee Valley Authority, the Forest Service, the Bureau of Reclamation, and the Bureau of Indian Affairs.

For effectiveness, soil-survey work is coordinated on a national basis so that similar soils are everywhere given the same names and descriptions in all States. At the same time, the State scientists contribute their detailed local experience. This cooperative basis makes it possible to have the benefits of both local and national experience and to develop a common nomenclature that fits the local conditions.

The Bureau not only sees that soil types are accurately and uniformly defined and mapped but also coordinates the results of plant and soil research with the findings regarding soil types and soil groups recognized in the system of classification. The important differences which occur among soils in every area modify the results of fertilization, liming, tillage, drainage, irrigation, erosion control, and other cultural practices. They affect the performance of various crops and crop varieties. Soil classification and soil maps become



the medium for applying to specific fields, farms, and rural communities the research findings as related to particular soil types.

Examples of Progress and Current Program:

Soils Improvement, Management, and Irrigation Investigations:

Note: This project is a consolidation of the work previously reported under three projects, (1) Dry Land Management, (2) Irrigation Practice, Drainage, and Salinity Control, and (3) Soil Management and Fertilization for Crop Production. It reflects the consolidation in fiscal year 1946 under one organizational unit of all of the field investigational work relating to soils of the humid region, dry land region, and under irrigation, and the close coordination which exists between such field work and the research studies of basic soil and plant relationships. The previous projects did not indicate the soil management investigations now being conducted in the humid region (which comprises 31 states and constitutes the major agricultural region of the United States) nor did they reflect the close inter-relationship between the field work of the various regions, or between the field work and the basic research work. As shown by the budget schedules relating to "By Projects or Functions" the work under this project in 1947 is distributed as follows:

Management of soils in the humid region.....	\$19,350
Management of soils in the dry land region..	236,320
Management of soils under irrigation .....	302,300
Basic soil and plant relationships, including tilth, moisture, fertility, and soil organisms .....	152,230
	\$710,200

Fertility status of potato soils. The survey of the fertility status of soils from commercial potato farms of the Atlantic Coast and Gulf States was extended to include Alabama and Virginia. The data from all soil samples have been analyzed and permit the following generalizations. There was a marked accumulation of readily soluble phosphorus in all soils investigated. This accumulation varied, depending on the chemical characteristics of the soil and on the farm management practices, particularly the number of years a soil had been under intensive fertilization. In some areas, and on certain soils where heavy application of phosphorus had been applied in 5, 10, or 20-year periods, the level of available phosphorus was such that little or no reduction in potato yields resulted when the phosphorus content of fertilizer was materially reduced or even eliminated. In Maine, the results of experiments conducted on the rate of fertilizer application for several varieties of potatoes, on soils with varying initial levels of plant nutrients as measured by chemical analysis, indicate that the general practice in the area has been to apply too much nitrogen to potatoes grown for the early harvest. No significant increase in yields was obtained from applications of nitrogen above 80 to 100 pounds per acre. In a number of instances actual decrease occurred from a higher application. On many farms more potash is added than will increase the yields.

Increased yield from better management. That improved soil and crop management practices increase yields is illustrated by comparisons of data obtained from average farm operations in the Huntley reclamation district with data from the U. S. Department of Agriculture, Huntley Field Station in Montana. For the 4-year period 1942-45 the average nearby-farm alfalfa yield in the district was 2.2 tons per acre, as compared with 4.88 tons obtained on selected plots at the field station. As each better management practice was adopted, crop yields generally increased. In a 6-year rotation at the field station, the average annual yield of alfalfa for 3 years, 1942-45, was 3.31 tons per acre; where manure was added the average yield was 4.09 tons; and where there were applications of both manure and mineral fertilizers the average yield was 4.88 tons. In a 6-year rotation at the station containing 3 years of alfalfa, the average acre yield of potatoes was 279 bushels. Adding manure and mineral fertilizers and following other good management practices increased the yield to 419 bushels. However, in the irrigation district during the same period the average farm yield where potatoes were grown continuously was only 90 bushels. Other crops, beans, oats, and sugar beets, showed similar responses to better management practices.

Spring droughts and the row-crop farmer in the Southwest. A severe winter and spring drought need not mean crop failure to the row-crop farmer growing grain sorghums in the Southwest. Studies of 41 years of climatic records at Tucumcari, New Mexico show that, with a single exception, a dry spring has always been followed by normal or above normal precipitation during the period from June to August. A spring drought may be disastrous to the rancher and may wipe out a wheat crop but the row-crop farmer who is ready to take advantage of summer moisture can produce a crop on surprisingly low precipitation. To do this he must be ready to plant when the drought breaks. Good seed is essential because planting may be delayed until replanting is out of the question. There are several early-maturing combine sorghum varieties available which should be used if planting has to be delayed until late June.

Seasonal conditions affect nutritive quality of grasses. Chemical analyses of pasture grasses at Hoccasin, Montana show why it is necessary to graze crested wheatgrass and brome grass heavily in the spring if their full feed value is to be realized. Both of these grasses were high in protein in the early spring, and the protein level remained at a satisfactory level during most of June. Later in the season the protein content was lower than that of native grass. Crested wheatgrass was particularly low in protein during the late summer, fall, and winter.

Aid to settlers on new irrigation projects. To promote initial success and permanency of crop production on newly irrigated soils in the Lower Colorado River Basin, Arizona and California, a research program has been initiated in cooperation with the respective State agricultural experiment stations and the United States Bureau of Reclamation. This program was begun before completion of the irrigation pro-



jects in order to obtain as much information as possible on crop production and water use before the land was opened for settlement. Such advance information in regard to management practices is essential to insuring the continued productivity of the newly irrigated soils.

Preliminary results indicate that an early potato industry may be possible. Potato yields generally have not been as high as successful commercial production would demand, although the best treatments in the experimental plantings gave yields approaching this level. Present indications are that much can be done to increase yields further, reduce costs, and to obtain earlier maturity. Potatoes following alfalfa gave yields 20 percent higher than potatoes planted on new land. Use of manure at planting time gave vigorous early growth and was the outstanding fertilizer treatment in effect upon yields. Plots irrigated every other day increased yields over plots irrigated every fourth day. December planting gave larger yields than January, and closer spacing, -- 6 inches, instead of 9 to 12 inches -- increased yields where moisture and fertility were adequate.

In the Columbia River Basin soil management and crop production research on the newly irrigated lands is under way. Formal cooperation has been established among the Bureau of Plant Industry, Soils, and Agricultural Engineering, the Bureau of Reclamation, and the Washington Agricultural Experiment Station. All personnel have been selected and are on the job. Since funds for the program were not available until July 1, 1945, field experiments could not be conducted during the 1945 growing season. Laboratory and greenhouse experiments were started in the fall of 1945 and field experiments were initiated in the spring of 1946. A balanced and coordinated program of investigations has been planned cooperatively with the other interested agencies. Research results on some phases of the program will be available within the next year. The tempo of the research is designed to supply answers to the most critical problems of soil management and crop production by the time the areas are opened for settlement.

Irrigation methods for water economy. Experiments in irrigation practice have demonstrated that type of crop and character of soil determine the frequency of irrigation and the rate of application that provide for the most economical use of irrigation water. Results at Prosser, Washington, show that sugar beets are unable to utilize water efficiently from the lower soil horizons. Small grains, corn, and grass pastures also obtain most of their moisture from near the surface. On these crops the most efficient use of water is attained when irrigations are frequent and light. Alfalfa, on the other hand, uses about as much water from the second and third foot depths as from the surface soil, so that heavier but less frequent irrigations are desirable.



The use of water by plants varies between crops and between areas. For example, the seasonal requirement for alfalfa at Bard, California, was 6.2 acre-feet and that of barley, 1.6 acre-feet. Requirements for the same crops at Huntley, Montana, were 4.1 and 1.7 acre-feet, respectively. Potatoes and sugar beets proved to be intermediate in their water requirements.

Effect of herbicides and insecticides on soil micro-organisms.

Further observations on the effect of herbicides on soil micro-organisms were made by studying the effect of applications of 2, 4-D on the total number of viable micro-organisms and of fungi, actinomycetes, protozoans, and nitrite- and nitrate-forming bacteria. Two soils (Cody silt loam and Branchville sandy loam) were treated at rates of 1, 2, 10, 50, and 200 pounds per acre, with an additional application of a 1,000-pound rate to part of the sandy soil. The only groups affected were the nitrite- and the nitrate-forming bacteria. These were greatly reduced in both soils by the 200-pound application.

Investigations showed that application of DDT at rates of 25, 50, 100, 200, and 400 pounds per acre in the same two soils had no effect on any of the soil micro-organisms over a period of 7 months. The results of laboratory, greenhouse, and field experiments to date demonstrate that DDT has no effect on soil micro-organisms.

Fertilizer Materials and Improvements:

Storage of ammonium nitrate. Several types of ammonium nitrate fertilizer, as packaged and marketed commercially in the spring of 1945, were subjected to exhaustive storage tests. The bagged materials were subjected both to normal climatic variations of temperature and humidity, and to a constant temperature of 95° F. and 85 percent relative humidity. In general all materials showed satisfactory storage properties but those which had been pelleted were in somewhat better condition than those which had not.

Progress toward development of fertilizer compounds which will gradually release nitrogen to plants. The present types of chemical nitrogen fertilizers are readily soluble in water, leach easily from the soil, and supply nitrogen to plants for only a short period after their application to the soil. During the past year, work was started on the development of non-leaching, synthetic compounds which will gradually release nitrogen to plants at predetermined controllable rates. Such compounds should be particularly useful in fertilizing forage and other long-season crops and for use on sandy soils where leaching is a serious problem. Although the work is only in the initial stages, there are indications that compounds having the desired properties can be prepared. Much more work remains to be done, however, to determine the most suitable compounds for specific purposes and to develop economical methods for their production.

## Soils Classification for Crop Production:

Completed and published soil surveys. Detailed soil surveys of somewhat more than 1,100,000 acres were completed during the past year, largely by scientists in cooperating State Agricultural Experiment Stations. The total number of published surveys was increased to 1,550 by the addition of the following 10: Bakersfield area, California; LaPorte and Morten Counties, Indiana; Calloway County, Kentucky; Linn County, Missouri; Lincoln County, Tennessee; Salt Lake area, Utah; and Princess Ann, Russell, and Washington Counties, Virginia.

Soil data basic to farm planning. The pressing needs for food production throughout the country, as well as continuous efforts in soil conservation, emphasize the work of definition, nomenclature, and classification of soil types even in advance of progressive detailed soil mapping. In individual farm planning, as in soil conservation districts, proper soil identification is essential for the prompt and effective application of improved practices gained from scientific research. A number of special field studies in many places previously unsurveyed were undertaken to define soil types and correlate their descriptions and names with the established system of soil classification. In many instances combined field and laboratory studies were conducted to define the soils and establish their essential similarity to other soils so that their responses to different management practices could be determined.

(e) Agricultural Engineering

Objective: The broad objectives of agricultural engineering research are to (1) increase efficiency in farming operations, (2) reduce labor requirements, (3) decrease the costs of production, (4) improve the quality of farm products through the development of efficient machinery and methods in both production and primary processing on farms and by local cooperative enterprises, and (5) develop safe storage facilities for field crops and vegetables. More detailed specific objectives are as follows:

- (a) To improve existing and to develop new types of farm machinery for producing and harvesting crops.
- (b) To provide for more economical and efficient placement and use of fertilizers.
- (c) To devise spraying, dusting and related mechanical equipment for the control of insect pests and plant diseases.
- (d) To improve equipment and methods for the primary processing of cotton, flax, ramie and other field and livestock products.
- (e) To devise safe and economical storages for wheat, corn, potatoes and other products.
- (f) To improve the comfort, usefulness, and construction of rural houses, and to design more effective farm buildings better meeting the functional requirements of livestock and the requirements of efficient chore operations.
- (g) To develop new uses for electricity on farms and to adapt and improve electrical equipment so as to facilitate and improve farm operations and reduce costs.

The Problem and its Significance: Agricultural engineering in its broad sense is the application of engineering principles to agriculture. Engineering principles, however, have not been applied to agriculture to the extent they have in industry. The opportunities are great. Improved farm equipment--the farmers' production tools--and improved farm buildings, where the meat and other animal food products are developed and partially processed, should increase the efficiency and economy of many farm operations and permit the farmer to enjoy the benefits of engineering progress.

Agricultural engineering research, in collaboration with soil and plant research, is directed toward the designing of more efficient farm implements for improving practices in crop production, harvesting, handling and storing. Contributions of agricultural engineering research of this type aided materially in the record production of farm crops with less labor during the last few years. These records were made with a reduction in farm employment as follows:

	<u>Family Workers</u>	<u>Hired Workers</u>	<u>Total</u>
1910-14 av.	9,160,000	2,892,000	12,052,000
1935-39 av.	8,352,000	2,568,000	10,920,000
1940	8,019,000	2,566,000	10,585,000
1945	7,726,000	2,118,000	9,844,000



Research on further improvements in farm machinery offers one of the greatest possibilities for increasing efficiency and reducing production costs of the American farmer.

Agricultural engineering research in collaboration with animal husbandry and dairy industry research, is also directed toward the improvement of animal production practices. Farmers have been building or are having built for them, animal shelters and other farm structures based on ideas and opinions conceived principally in urban construction. Little information is available on the fundamental requirements of housed animals; that is, the required amount of air, desired temperature, humidity, and freshness. These factors affect animal efficiency as they do that of humans. Unsatisfactory conditions in animal shelters are paid for in increased feed, reduced weight, higher incidence of disease, or lowered milk production. Exact determination of these fundamental requirements will provide a basis for designing, constructing, and equipping farm buildings for efficient livestock production. Similar problems pertain to dwellings and their equipment as well as to farm building arrangement. New construction materials and methods, and changing farm practices increase the need for these investigations.

Many farm crops and products, such as cotton, flax, ramie, and other field and livestock products can be processed to advantage on or near the farm provided suitable equipment has been developed. Such processing has many advantages including the elimination of transportation charges on waste products, improvement of quality, and the creation of additional employment in rural areas. There is need for the development of new and improved equipment for such processing. For example, the introduction of mechanized harvesting of cotton, which results in a greater amount of trash in the cotton, creates new cotton ginning problems. The production of flax can be stimulated and farmer's incomes increased by the improvement of fiber flax processing equipment. Agricultural engineering research directed toward the improvement of existing equipment and the development of new processing machinery offers increased profits to the farmer and reduced costs to the consumer.

The extension of rural power lines emphasizes the need for research to provide electrical equipment which will improve farm facilities, save labor, and reduce costs. These include the development or extended use of automatic grinders and feed processors, water heaters, farm freezers, manure handling equipment, blowers for drying crops, bactericidal lamps, electric heaters and driers, and other equipment. Many new electrical contrivances which are being found for home or industrial use can be adapted to farm use.

General Plan: The agricultural engineering investigations are conducted in laboratories and in the field in cooperation with other agencies of the Department, State agricultural experiment stations, and others. The location of the laboratories is governed primarily by the areas in which the particular problems under investigation

occur. Some of the more important investigations and the headquarters for the work are as follows:

<u>Investigations on</u>	<u>Location</u>
Tillage machinery.....	Auburn, Ala.
Cotton ginning and cotton machinery...	Stoneville, Miss.
Sugarcane machinery.....	Houma, La.
Tobacco curing barns and equipment....	Oxford, N. C., and Tifton, Ga.
Sansevieria, ramie and other fiber processing.....	Boynton, Fla.
Sweetpotato production machinery.....	Tifton, Ga.
Hay drying.....	Blacksburg, Va.
Fertilizer placement, rural housing and farm buildings, poultry shelters and electric power utilization.....	Beltsville, Md.
Electrical equipment for dairy use....	Storrs, Conn.
Pest and plant disease control machinery.....	Toledo, Ohio
Dairy cattle housing.....	Columbia, Mo.
Crop storage and handling.....	Ames, Iowa, Urbana, Ill., Ft. Collins, Colo., and Athens, Ga.
Sugar beet machinery.....	Ft. Collins, Colo.
Fiber flax processing.....	Corvallis, Ore.
Swine shelters.....	Davis, Calif.

#### Examples of Progress and Current Program:

##### Farm Mechanical Equipment:

Airplane spraying equipment improved. Improvements have been made in airplane spraying equipment for more rapid and effective control of the European corn borer and insects which destroy forests. During the past year, a new boom-type sprayer was developed and tested. This type of device applied DDT in oil at approximately 2 gallons per acre in a 35-foot swath at the rate of about 10 acres per minute. Used against the corn borer in sweet corn, an average borer reduction in the stalks of 83 percent and in the ears of 92 percent was obtained. A similar unit used in a larger plane for forest insect control applied one gallon of DDT in oil per acre in a 100-foot swath at the rate of 18 to 20 acres per minute. The work on insect control equipment is cooperative with the Bureau of Entomology and Plant Quarantine.

Improvements in sweetpotato cultivation and harvesting. Work on the development of a sweetpotato vine harvester indicated that proper shape of the beds would make harvesting of the vines easier. An arrangement of sweeps and disks was devised during the year for use in making beds of uniform shape for planting sweetpotato slips two rows at a time. For cultivating, two-row equipment fitted with spring teeth with narrow shovels and 26-inch sweeps is used. The shovels break up the soil and lay the vines on top of the rows; the sweeps are used to pull the soil up the bed and keep it of uniform shape, thus making it easier to remove the vines with mechanical equipment.



With the vines removed from the fields, an Irish-potato digger has been successfully used for harvesting the sweetpotatoes themselves. Experience during the last season indicates that such a digger mounted directly on a tractor, can be developed into a real labor saver that can be used in almost any soil suitable for growing sweetpotatoes or where a tractor can be driven.

Mechanization of sugar-beet production is developing rapidly as a result of equipment studies for this crop. Several developments from these studies, including the disk topper, sorting table for separating the beets from the clods in the heavier soils, and variable cut topping and driven-wheel finder were incorporated into the design of new sugar beet harvesters built in 1946.

It is estimated that as high as 80 to 90 percent of the acreage grown in the United States is now being planted with sheared or segmented (single-germ) seed. Improvements in equipment and planting techniques were further developed during the year whereby suitable stands and only slightly decreased yields were obtained with savings of up to 60 percent of the thinning and hoeing time normally required.

#### Farm Structures and Related Investigations:

Investigations now under way are especially concerned with:

- (1) Simplification and lowering of the cost of farm house and other farm building construction;
- (2) Determination of the best temperature, air condition, and space allowances in livestock and poultry housing;
- (3) Economical methods of controlling temperature and moisture in vegetable and fruit storages;
- (4) Methods of drying corn and other grains and design of storage buildings; and
- (5) Economical lay-out of the farmstead to save time and effort in doing farm chores.

Livestock and poultry housing. Studies of the relation of the environment, particularly conditions within the barn or poultry house, to the producing efficiency of livestock have been resumed and two new laboratories for these investigations have been constructed. One of these, the Psychroenergetic Laboratory at Columbia, Missouri, will be used for determining the temperature, ventilation, and space requirements of dairy cows, the work to be carried on in cooperation with the Missouri Agricultural Experiment Station, the Bureau of Dairy Industry and the Bureau of Animal Industry. The other laboratory, located at the Agricultural Research Center, Beltsville, Maryland, will be used to determine the environmental requirements of poultry, in cooperation with the Bureau of Animal Industry. Because of difficulties in obtaining equipment, the two laboratories are as yet not fully completed. It is expected, however, that preliminary studies will be made during this year.

The lack of basic information on animal housing has disturbed farmers, scientists, and farm building engineers for many years. Building designs have been based largely on experience and opinion. Lack of



information has led to costly mistakes in the fabrication of farm buildings by industry, to excessive expenditures by farmers, and to unknown losses in farm production. The investigations are designed to obtain the fundamental data needed to place design and construction of livestock and poultry buildings on a sound basis.

These tests should show the farmer where he can save in dollars and cents by constructing the right types of buildings to enable his livestock to produce most efficiently, and should furnish engineers and designers the information they need to plan more effective livestock houses.

Housing and farm building information. Because of changes in farming methods and in the availability of materials, it has become necessary to revise or replace many of the plans and publications that have been issued on farm houses and buildings. Revisions of such publications are progressing rapidly. In the field of farm housing, the research studies were discontinued during the war. Such studies are now being resumed. Scientific information on housing in form usable by farmers and rural builders is needed if mistakes are to be avoided in construction in the years immediately ahead, and if farmers are to get houses and other buildings that are functionally adequate.

Agricultural engineers are working closely with the housing specialists of the Bureau of Human Nutrition and Home Economics to incorporate into plans and publications information on minimum standards and good functional design for farm houses. They are undertaking cooperatively the preparation of a series of popular publications under the general title "Your Farmhouse." The first manuscript in this series, "How to Plan Remodeling," has already been completed. The two bureaus also are cooperating with the agricultural colleges of the Northeastern States in preparing a series of new farmhouse plans for use in that region. The new plans will be available through the states' Agricultural Extension Service.

Progress in soybean storage studies. In a series of tests conducted in cooperation with the Illinois Agricultural Experiment Station, the effect of moisture content on the rate of deterioration of stored soybeans showed no loss in grade at the end of 21 months where the moisture content of the soybeans at the time of storage was below 11 percent. Serious deterioration occurred after 10 months storage in soybeans having 13.5 to 13.9 percent moisture content and after 21 months in soybeans having 12.2 to 12.5 percent moisture content when stored. Wind ventilation proved unsatisfactory as a means of drying soybeans in storage. Forced ventilation from a gasoline-engine driven fan arranged so that heat from the engine warmed the ventilating air, gave the most satisfactory results.

#### Mechanical Processing of Farm Products:

Ginning machine-picked cotton. Use of special equipment in the ginning of machine-picked cotton in tests at the Stoneville (Mississippi) Cooperative Cotton Ginning Laboratory has resulted in an increased

value of about \$5 a bale of cotton above the value obtained from the conventional ginning methods. Special equipment is needed to gin the machine-picked cotton because the mechanical cotton harvesters pick up more dirt and trash than is the case in hand picking. Tests show that the best combination of equipment for ginning the machine-picked cotton includes a tower drier, master extractor, and a special cleaner with 12 cylinders in addition to the equipment ordinarily found in cotton gins. The additional equipment, however, adds considerably to the investment in the gin and decreases the rate of ginning so that daily production is reduced about 10 percent.

Varieties of cotton having slick and glossy leaves are easier to clean than those with leaves which attach themselves readily to the lint. Tests have shown differences between varieties of \$87.44 to \$119.18 in bale values. The higher values resulted largely with varieties whose leaves were more easily removed from the lint.

Oil mist reduces gin fire hazards. The application of certain sulphanated oils to cotton in the form of a thin mist has proved very satisfactory in reducing the fire hazard and insuring smooth flow of the cotton through the ginning process in experiments carried on during the last year. The ginning of cotton in some sections of the South is ordinarily carried out with considerable risk of fire because of the extreme dryness of the cotton and the dust which is extracted from the lint. Static electricity within the gin itself sometimes produces both a fire hazard and an interference with the operation of the gin, causing the cotton to bunch up, clogging the gin machinery, and preventing uniform packing of the lint in the press box. A number of gins in the South have already adopted this oil mist process. Only a small quantity of oil is required and the cost of both the oil and the spraying equipment is a minor item.

Drying cotton seed for storage. Farmers in many parts of the Cotton Belt are faced with the problem of drying cotton seed so that it may be stored for considerable time without affecting the quality or quantity of the oil or the viability of the seed. Tests have demonstrated that cotton seed can be successfully dried for safe storage by exposure to a temperature of 200° F. for 7 minutes or to a high temperature of 460° for a period not exceeding 45 seconds without endangering the viability of the seed. A compact drier, using the high temperature-short exposure method, has been built which in preliminary tests has operated efficiently.

#### Utilization of Electric Power on Farms:

Improvements in drying hay and forage crops. (For improvements in quality of hay and forage crops resulting from mow-drying, see discussion under "Forage Crops"). Improvements in the design of mow-driers and the slatted floors of hay-mows were developed in cooperation with the Virginia Agricultural Experiment Station. Baffle boards are used to direct the air upward through the hay and to allow less air to be dispersed along the floor and up the sides. Greater rates



of air flow with better air distribution were obtained without increasing the power required to operate the fan. Results were sufficiently satisfactory so that more than 200 installations of this type have been made on Virginia farms and are giving very satisfactory results.

In cooperative hay-drying experiments in 1946 it was found that the use of air heated to 100° F. reduced the drying time by as much as two-thirds as compared with hay dried by air-blowers operating without heated air, but otherwise under similar conditions. Better quality hay was obtained when heated air was used.

Curing bright leaf tobacco. Investigations on the use in tobacco barns of electric controls to regulate temperatures and humidity, electric fans to distribute the heat more uniformly inside the curing barns, and on the development of new types of tobacco barns were started at Oxford, North Carolina, in 1945 in cooperation with the North Carolina Agricultural Experiment Station.

It is estimated that in 1945, green tobacco put into the curing barns weighed approximately 5 million tons, and since green tobacco contains 90 percent water, approximately  $4\frac{1}{2}$  million tons must be evaporated from the annual flue-cured crop. There is great need for the development of labor saving devices for handling the crop, for the prevention of fire losses, and for methods which will improve the quality of the cured tobacco. Preliminary investigations have shown that fuel costs can be reduced as much as two-thirds by improvements in design and operation of curing barns. Where coal is used as a fuel, the savings in fuel costs per barn would approximate \$40.00 for five curings per season. Experimentation with the use of blowers to circulate the heated air more uniformly through the tobacco gives promise of improving tobacco quality as well as reducing operating costs.



(f) National Arboretum

Authorization: The National Arboretum was established pursuant to the authorization contained in the Act of March 4, 1927 (20 U. S. C. 191-194). It is located in the District of Columbia and bounded approximately by M and R Streets, N. E., Bladensburg Road, and the Anacostia River. An advisory council, appointed by the Secretary of Agriculture assists in planning the development of the Arboretum. Plant collections generally are established in nurseries at the Arboretum prior to being placed in permanent plantings. Plant materials are obtained by purchase, gift, and by transfer from the Bureau's Division of Plant Exploration and Introduction, a source of exotic plants from foreign countries.

Purpose: The essential purpose of the Arboretum is the development of a living collection of all woody plants that can be grown in this area to serve as a source of plant materials and educational information concerning plant life not only for students and scientists throughout this country but also for visiting scientists from all over the world. The establishment at the Arboretum of a great storehouse of plant materials from all corners of the world would provide opportunity to breeders of trees, shrubs, and flowers to cross native species with those from foreign lands for the development of improved strains adapted for special purposes such as for city parks, forests, boulevards, and streets.

Developmental Plans: The Arboretum now consists of approximately 395 acres. Present improvements consist of several temporary wooden buildings for housing equipment, four small temporary propagation greenhouses, a skeleton road system, and a partially developed drainage system. Some basic developmental work has been done, including the clearing of land, making of soil surveys, and the collection of information on species of trees and shrubs adapted to the climate of the area. Plantings have been started and a large amount of plant material is being maintained in nurseries awaiting transfer to permanent planting sites.

Plans for the long-term development of the physical facilities at the National Arboretum are being developed in cooperation with the National Arboretum Advisory Council. They include (a) the acquisition of six small tracts of land needed to round out the boundaries of the Arboretum, (b) the erection of an administration building which will provide adequate facilities for an herbarium collection, library, study cubicles, group meetings, as well as offices; (c) the erection of greenhouse facilities for growing collections of plants not hardy enough to be grown out-of-doors in this climate and for propagating plant materials for use in the Arboretum, also service buildings and residences for the superintendent and propagator, and (d) the installation of roads and utilities adequate for great numbers of anticipated visitors to the Arboretum.

Current Operations: Work at the National Arboretum for the duration of the war was primarily on a maintenance basis. With the aid of an increase of \$45,000 in the 1947 Agricultural Appropriation Act which brought the total appropriation up to \$76,000, work was immediately started on transplanting nursery stock to prevent widespread losses of plant materials. First attention was given to planting the huge azalea collection on the southern flank of Mt. Hamilton, which has been cleared and the soil prepared. These plantings will constitute one of the largest collections on the Atlantic Seaboard and will contain clonal varieties nowhere else available. A preliminary woods trail was constructed to the top of Mt. Hamilton which has been used as a service road. Repairs to the drainage control structures are being made during the winter while the transplanting season is closed.

Considerable herbarium material, consisting of accurately named collections of woody and other plants, accumulated during the war years. Added professional assistance has made it possible to begin properly to mount, label, and file this material so that it is readily accessible for reference purposes in conjunction with the work on living collections.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Special Research Fund, Department of Agriculture (Bureau of Plant Industry, Soils, and Agricul- tural Engineering):			
Special research laboratories	\$317,800:	\$345,700:	\$345,700
Special research projects ...	125,660:	137,200:	137,200
Total, Special Research Fund:	443,460:	482,900:	482,900
Research on Strategic and Critical: Agricultural Materials (Bureau of Plant Industry, Soils, and Agricultural Engineering): For			
investigations to develop in			
accordance with Section 7(b)			
of the "Strategic and Critical:			
Materials Stock Piling Act of			
July 23, 1946" domestic			
sources of natural rubber from:			
guayule and other rubber			
plants for use in times of			
national emergency .....	- -:	- -:	170,000

(Continued on next page)

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
<u>Salaries and Expenses, Soil Conservation Service (Bureau of Plant Industry, Soils, and Agricultural Engineering):</u> Inspection and correlation of soil surveys made by the Soil Conservation Service	185,254:	213,400:	215,500
<u>Emergency Fund for the President, National Defense (Allotment to Agriculture) (Bureau of Plant Industry, Soils, and Agricultural Engineering):</u> For emergency plant disease prevention .....	6,702:	- -:	- -
<u>Rubber Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering:</u> Development of rubber production in the Western Hemisphere (Adjustment of prior year obligations) .....	- -:	24:	- -
<u>Emergency Rubber Project, Department of Agriculture (Bureau of Plant Industry, Soils, and Agricultural Engineering):</u> Investigations directed toward the production of rubber from guayule .....	113,956:	10,000:	- -
<u>Working Fund, Agriculture, Bureau of Plant Industry, Soils, and Agricultural Engineering (Advance from Commodity Credit Corporation, Capital Fund):</u> Development of methods of properly caring for grain in storage .....	1,621:	1,560:	- -
<u>Miscellaneous Contributed Funds (Bureau of Plant Industry, Soils, and Agricultural Engineering):</u> Trust funds deposited by co-operators for cooperative work, as follows:			
1. Improvement and management of turf grasses, and control of weeds by chemical treatment .....	1,756:	3,571:	3,571
2. Collection of planting material of sugarcane species and varieties for the American sugarcane areas:	- -:	2,000:	- -

(Continued on next page)



Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
<u>Miscellaneous Contributed Funds</u>			
<u>(Bureau of Plant Industry, Soils, and Agricultural Engineering):</u>			
Trust funds deposited by coop- erators for cooperative work, as follows: (Cont'd)			
3. Investigations on the con- trol of diseases of truck crops .....	- -	67:	- -
4. Investigations on the pro- duction of morphine for medicinal use from the poppy plant .....	- -	100:	200
5. Collection and testing of seeds of sorgo species and varieties .....	2,523:	3,000:	- -
6. Floricultural research on new methods of production and propagation, development of new varieties and methods of disease control .....	- -	500:	- -
7. Hybrid onion research to develop improved high- yielding disease-resistant varieties .....	300:	700:	- -
8. Investigations on growing, harvesting, and testing of ramie, sansevieria, kenaf, and other fiber plants in Florida .....	- -	1,500:	- -
9. Production of parent or foundation cotton seed to meet the needs of the one- variety program in California:	- -	6,463:	- -
10. Miscellaneous foreign seed shipments .....	18:	- -	- -
Total, Trust Funds .....	5,097:	17,906:	3,771
<u>Penalty Mail Costs, Department of Agriculture (Allotment to Bureau of Plant Industry, Soils, and Agricul- tural Engineering): For cost of penalty mail pursuant to Section 2, Public Law 364, 78th Congress ....</u>	7,179:	8,500:	9,660

(Continued on next page)

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Cooperation with American Republics	:	:	:
(Transfer from State Department):a/	:	:	:
Investigations directed toward	:	:	:
plantation rubber production in	:	:	:
the Western Hemisphere .....	b/ 311,436:	b/ 341,183:	335,012
TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL:	:	:	:
FUNDS .....	1,074,755:	1,075,473:	1,216,843

a/ Schedule for this item appears in the State Department chapter of the Budget.

b/ Includes \$7,214 in fiscal year 1946 and \$2,249 in fiscal year 1947 for studies of grasses in Brazil.





BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

(a) Insect Investigations

- Objective: (1) To develop means whereby the growers of fruits, nuts, truck and garden crops, cereal, forage and range crops, cotton, tobacco, sugar plants and other agricultural products, can control insect pests more effectively or more economically, thus increasing the net returns from their operations and insuring an ample supply of high-quality agricultural products;
- (2) To devise the most effective and economical means of preventing or controlling insect damage to forest and shade trees, forest products and shrubs;
- (3) To reduce losses from bee diseases, to promote better methods of apiary management for honey and wax production and for pollination, and to provide for the use of superior strains of bees;
- (4) To develop control measures for those insects which transmit disease, annoy man, and attack livestock;
- (5) To devise the most effective and economical means of preventing or controlling insect damage to stored agricultural products, foods and fabrics;
- (6) To identify insects and allied organisms for the quarantine, control and research activities of the Bureau of Entomology and Plant Quarantine and other Federal and State agencies, farmers, pest control operators, and other private individuals of the United States, as well as for foreign institutions; and to collect, maintain, and furnish information as to the presence and abundance of insect pests;
- (7) To develop methods and apparatus for freeing commodities of pests under plant quarantine regulations so that they can move freely and safely in commerce; and to improve the chemical materials now employed in controlling insects, to develop new and better chemical materials, and to devise improved apparatus and methods for their application.

The Problem and its Significance: The problems encountered and the importance of solving them are discussed in the following paragraphs which are numbered to correspond with the objectives stated in the preceding section.

- (1) Unfortunately all crops are subject to serious attack by insect pests. Losses due to these attacks vary with the crop and the season but the average annual loss from this source is high in spite of the available knowledge about insect control. These losses are due in part to failure to apply known methods thoroughly and timely, in part to the imperfect control measures available for many pests, and to their cost. For example, including the cost of control measures, codling moth still exacts a toll of \$50,500,000 per year and some growers spend \$50 to \$60 per acre for control and still suffer losses. Corn earworm causes an average annual loss of \$147,700,000 to corn alone and in addition

does serious damage to tomatoes and cotton. Cotton insects including the boll weevil caused an average loss of approximately \$163,209,000 or nearly 12% of the value of the cotton crop for the period 1941 through 1945. Truck crops are especially subject to attack by a great variety of pests and annual losses are high. Losses of this type represent not only a severe financial burden to producers but also constitute a grave handicap to agricultural production to meet domestic and world demands.

(2) Insects affecting forests and forest products are estimated to cause losses of more than \$166,000,000 annually. This destruction is especially serious now because of the greatly increased demands for lumber and other forest products. This makes it particularly essential to protect the reserve supply of standing timber and the large quantities which have been cut for lumber and other purposes. It is also important to be in position to advise forest managing agencies, wood using industries, and those responsible for construction activities, all of which have called for assistance and advice in applying control measures.

(3) Beekeeping is practiced in every state of the United States. There are more than 5,460,000 colonies representing an investment of approximately \$60,060,000 with an annual production of about 233,000,000 pounds of honey and 4,500,000 pounds of beeswax. This represents an important commercial investment which should be protected by the best advice and service possible to the beekeeper.

It is even more important, however, to promote apiculture because of its relationship to the pollination of agricultural crops. Field studies indicate that honeybees perform at least 80% of the pollination which is essential to the production of almonds, apples, pears, plums, cherries, small fruits, melons, cucumbers, vegetable seeds, cotton, clover and alfalfa seed. It is also of importance in the maintenance of pastures and ranges. When the values of these crops are considered, it becomes apparent that the encouragement of beekeeping has an importance in the field of agricultural production far beyond the value of the wax and honey produced.

(4) The part played by insects in the transmission of disease to man and animals in the United States and the losses attributable to direct attack on farm animals is so important as to make it imperative that the habits and life history of these insects be clearly understood so that effective control measures can be developed. Production of beef, mutton, poultry, Mohair, wool, hides and dairy products is greatly affected by the depredations of many insect pests such as screwworms, biting flies, cattle grubs and lice. Horse raising and farming operations are also adversely affected by insects such as horse bots, stable flies and buffalo gnats. Malaria has always had a considerable incidence and fatality and in certain states the loss of work time and operating efficiency resulting from this disease is extremely high. It seems inevitable that troops returning to the United States from malaria infested areas will add to the problem of

control of such diseases as malaria, dengue, and filariasis, all of which are carried by species of mosquitoes new within the United States.

(5) The insect problem in relation to agricultural products by no means ceases with the harvesting of crops. Tremendous damage has been done by insects to stored fruits, tobacco, grain, and fabrics. It is estimated, for example, that grain and flour weevils and moths have damaged stored grains and cereal products to the extent of more than \$360,000,000 annually. It is important to give every possible assistance to farmers, millers, warehouse operators, and others in protecting these products.

(6) There are many hundreds of thousands of different kinds of insects. Numerous species within many given groups resemble each other so closely as to appear identical but frequently have such different habits as to require different kinds of control or regulation. The exact identification of insects is therefore fundamental to research, control, and regulatory activities as well as to the farmer who must know the identity of an insect before proper control measures can be applied. Identification of many species can be made only by experts from specimens especially prepared for study and in many cases only after extended research. It is, of course, fundamental that there be adequate and up-to-date information as to the distribution of various insects throughout the United States. This is essential not only to intelligent control efforts but also to the economical and effective use of our present restricted supply of insecticides.

(7) Despite the end of the war, there is still a shortage of certain standard insecticidal materials. At the same time there is a large demand for certain insecticides for the protection of agricultural crops and also to safeguard groups from disease-carrying insects. It is imperative, therefore, that new and effective insecticides be developed and that every effort be made to devise apparatus and methods which will make it possible to apply new insecticidal materials to the best advantage and to increase the effectiveness of those already in use. It is also essential that the restriction of movement of commercial commodities under quarantine regulations be held to an absolute minimum. This may best be accomplished by continued development of fumigation or other methods of treatment to allow the commodities to move freely without injury to themselves or the danger of spreading the pest involved.

General Plan: The research work carried on under this appropriation is under the direct supervision of appropriate subject-matter Divisions, as follows: Fruit Insects, Fruit Fly Investigations, Truck Crop and Garden Insects, Cereal and Forage Insects, Cotton Insects, Foreign Parasite Introduction, Forest Insects, Bee Culture, Insects Affecting Man and Animals, Insect Pest Survey and Information, Insect Identification, Control Investigations, and Insecticide and Fungicide Investigations. All of these Divisions have their administrative headquarters in Washington or at the Agricultural Research Center at Beltsville, Maryland, except Fruit Fly Investigations. However, with the



exception of the work on insect identification, the research is done at field stations situated throughout the United States in localities where the work can be carried on to the best advantage against the particular pests involved. There are approximately 120 such stations distributed throughout the United States. The work program is so coordinated as to provide for cooperation between two or more Divisions, when advantageous. Much of the research is also cooperative with other Bureaus and with the appropriate State Agricultural Experiment Stations or other State agencies.

Progress and Current Program: The following discussion indicates under the various financial projects the present trend of work under the respective programs and outlines briefly some of the recent accomplishments:

### 1. Fruit Insects

Substantial progress has been made on some projects, resulting in the completion of certain phases of investigations, thus releasing facilities for the prosecution of related work.

Improved methods developed in fumigation of citrus trees: In combating citrus and other subtropical fruit insects it has been established through cooperative work that with the use of gastight, plastic-treated tents in the fumigation of citrus trees it is necessary to use only about one-third as much cyanide for effective control of the California red scale as with the standard duck tent. A blower applicator which gives effective experimental control has been developed to the point where it is now ready for commercial testing. The completion of these phases of the work has permitted increased attention to the development of a device for removing the cyanide left under gastight tents at the end of the fumigation period in order to reduce the danger to operators. Definite progress has been made on this device and an experimental evaporator developed which removed most of the cyanide gas in less than 50 seconds.

DDT gives outstanding control of codling moth wherever tested: In the Shenandoah Valley control was practically perfect where DDT was applied in full schedules, and in Indiana DDT permitted only 2% wormy fruit in 1945 as compared with 14% for lead arsenate and 19% for tankmix nicotine bentonite. DDT dusts were fairly effective, but less so than DDT sprays. Despite the effectiveness of DDT the Bureau has not been in position to recommend it unqualifiedly for codling moth control for two reasons: First, its use has frequently been followed by serious outbreaks of mites and woolly apple aphids and second, it has left a residue on the fruit which closely approximates and in some cases exceeds the permissible administrative tolerance.

Comstock mealybug situation encouraging: Infestations in northern Virginia in 1945 were the lowest yet recorded and infestations in the southwestern part of the State were dropping. The mealybug continued to be scarce in Ohio and New Jersey and occurred in moderate abundance in certain orchards in Delaware and Connecticut. The two most common parasites of this insect continued to give effective results and to extend their distribution naturally. DDT proved to be highly effective against newly hatched crawlers of the Comstock mealybug but unfortunately is also fatal to its parasites. This relationship is being carefully studied.

Individual package fumigation effective against dried fruit insects: Individual package fumigation has been found more effective when the fumigant was applied to the surface of raisins after the boxes were filled instead of being pumped onto the bottom of the empty cases just before filling, which heretofore was the general practice. There have been excessive losses from insects in date gardens in southern California, amounting to \$450 per acre or more. Investigations started during the past year show that most of the damage is being caused by the dried fruit beetle and related insects. Biology studies are now being conducted on the more common species, and tests of fumigants started to determine the tolerance of date palms to them.

Parasites of oriental fruit moth operating effectively: Surveys in ten eastern States indicated that the areas in which parasites are operating effectively had been enlarged. It was determined that cocoons of the oriental fruit moth can winter over successfully on nursery stock when it is stacked in frost-proof storage. This study has been concluded, it having been established that the fruit moth can be carried to new localities on dormant nursery stock.

DDT effective against pecan insects: In Texas, Florida and Georgia, DDT gave promising results in the control of a group of pecan insects, including the pecan nut casebearer, the hickory shuck worm and the pecan weevil. Heavy lead arsenate applications in late August and September also gave some control of the pecan weevil..

New tests started in an effort to determine the insects that spread peach mosaic virus diseases and phony peach disease: A series of new tests was started mostly with aphids and thrips and certain technical improvements were made in the methods of conducting the tests. The result of previous tests were very largely negative, simply establishing the fact that the insects previously considered possible vectors of these diseases actually had not been responsible for their spread.

For the first time it was indicated that peach mosaic spread may occur in the spring through the petal-fall stage of tree development. This discovery serves to draw attention to insects present in orchards at that time of year in planning further tests.

The laboratory concerned with investigations of the phony peach problem was moved from Chattanooga, Tenn., to Fort Valley, Ga., in June 1946. The new location is in the center of an active spread phony peach area.

DDT was established as an outstandingly effective method of control against pear thrips on prunes in Oregon, and on apple maggot in the Hudson Valley of New York.

More than 200 experiments were initiated at Salt Lake City, Utah to determine insects that may transmit the Western X disease of peach and cherry wilt, both of which are destructive virus diseases of that area.



Trends in Japanese beetle populations: The area generally infested by the Japanese beetle increased from 32,900 square miles in 1944 to about 33,200 square miles in 1945. The actual population, however, was generally reduced below recent levels in the coastal area from Boston, Mass. to Norfolk, Va. This is attributable partly to the unusually dry summer of 1944 and partly to the more general distribution of milky disease of the grubs. Reports available from areas where observations have been made indicate that more favorable weather conditions brought about an increase in beetle infestation in 1946.

Adult Japanese beetles controlled by DDT in extensive field tests: DDT gave excellent control of adult Japanese beetles on grapes, early apples, peaches and a variety of miscellaneous trees and shrubs. No spray injury to fruit or foliage was observed, although there was an increase in mite infestation. It was also indicated that a small amount of DDT dust uniformly distributed throughout a refrigerator car under specified conditions may kill all Japanese beetles in the car.

Continued experiments showed DDT is superior to lead arsenate for grub control both as a turf treatment and for treating soil and nursery plants. Plants were unaffected except for some injury to strawberries. A significant feature is that DDT in the soil showed no loss in effectiveness after two years and its toxic effect was not reduced by the presence of common fertilizers and soil conditioners. Benzene hexachloride also proved promising for soil treatment.

A large-scale experimental control program was undertaken in the summer of 1945 at Blowing Rock, N.C. in cooperation with the North Carolina Department of Agriculture. In this program DDT was used in the treatment of some 255 acres of turf and gardens and also as a spray for several thousand trees and shrubs. The first season's result was a reduction in infestation of about 70%.

Milky disease production and distribution has been continued in cooperation with various State agencies and also with the Army Service Force on certain military reservations. A total of 6,863 acres were treated in 1945. An interesting sidelight is that spores of the milky disease organism stored in dried blood smears on glass slides have now remained alive and effective for ten years. The standard spore dust has lost little or none of its infectiousness after 6 1/2 years.

Investigations on fruitflies which are potential pests in continental United States:

Serious fruitfly gains access to Hawaiian Islands: In order to conduct investigations on this new and serious fruitfly which is an immediate threat to Hawaii and a grave potential danger to the mainland, it has been necessary to make rather substantial increases in the facilities of the laboratory of this project located in Hawaii. Corresponding reduction in the amounts allotted to activities in Mexico and the Canal Zone has resulted. The work of the two latter laboratories is valuable and important but it was imperative to build up knowledge on this new insect as rapidly as possible and to devise methods to prevent shipments to the mainland from transporting it.



Activities in the Canal Zone are being carried on in close cooperation with the units of the Bureau engaged in forest insect investigations, since the maintenance of an adequate organization there will permit of attention being given to the work on termites and will also permit of some continued attention to the fruitfly investigations.

Citrus blackfly control methods studied: Activity of the laboratory in Mexico has been shifted to provide for a limited study to develop control methods for the citrus blackfly. This is a very serious pest which has become injurious in Mexico, and which would have very detrimental effects should it gain entrance into the United States. The measures devised will be available for effective application should this pest become established in this country.

Valuable results continue to flow from the vapor-heat sterilization process developed by the Mexico City laboratory for Mexican fruitfly control. The Texas citrus industry has benefitted extensively from this process. Up to the end of May 1946, seasonal shipments of grapefruits which have been sterilized by this process totaled 105,698 tons. It is probable that a major part of this tonnage would have been cut off from markets had this treatment not been possible. Studies are being continued with a view to possible modifications that would shorten sterilization time and thus reduce the cost of the process.

## 2. Forest Insects

Spruce budworm outbreak: The insect was found to be abundant in the Adirondack region of New York in 1945 and in some areas the trees suffered almost complete defoliation of their new growth in 1946. Intensive studies of the biology, feeding habits, and effect of environment on spruce budworm abundance are being made, as well as cooperative studies with the U. S. Forest Service, State Foresters, and private timberland owners aimed at control of the budworm through forest management. An attempt will be made to transfer certain parasites, which do not occur in the East, from the Rocky Mountain region of Colorado to the Adirondacks.

The application of DDT by aircraft is being thoroughly investigated, certain phases of this work being conducted in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering and the New York State Conservation Department. Results thus far have been very encouraging although there is still much work to be done in improving uniformity of deposit, determining minimum effective dosages, and reducing loss of spray material.

Before DDT can be recommended for use over extensive forest areas its possible detrimental effects on the fauna of forests and streams must be determined. Exhaustive studies of this problem are being made in cooperation with the Fish and Wildlife Service of the Department of Interior and with some of the state agencies.

Bark Beetle Control Investigations: Effective control of the Engelmann spruce beetle was obtained by applying a mixture of one part orthodichlorobenzene and six parts fuel oil to the bases of trees containing hibernating beetles. Very promising results were also obtained by applying emulsions and suspensions of DDT to the bases of trees before the beetles entered them to hibernate. This is very important because it offers a method of control that can be employed through the summer months and thus lengthens what is otherwise a very short season during which control work can be conducted.

Experiments conducted in California indicate that treatment of logging slash with DDT is effective in preventing attack by Ips beetles. Slash that was lopped and scattered was not as heavily infested as when the tops of the trees were left intact on the ground. Areas where experimental control by salvage logging of infested trees was conducted in 1945 showed very little further loss in 1946 while check areas generally suffered considerable additional loss.

Subject to the limited resources available, some help has been given, particularly in the Pacific Coast states and in the northern Rocky Mountain region, in planning future logging operations so as to first remove the most insect-susceptible individual trees and forest stands.

Extensive surveys conducted in western forest lands: General observational surveys to locate serious bark beetle infestations and determine the need for control were conducted on approximately 10 million acres of western forest lands. Many large and important areas in the Rocky Mountain region have not been examined for several years and little or no information is in hand as to what the insects are doing. Aggressive infestations of the Black Hills beetle were found on the Wasatch, Ashley, Roosevelt, and Medicine Bow National Forests. A widespread outbreak of the Mountain pine beetle in lodgepole pine was found in the general region including the Caribou, Targhee and Teton National Forests and Grand Teton National Park. An outbreak of Fir tussock moth was found in western Idaho on 350,000 acres of Douglas and true fir with serious defoliation present on about 150,000 acres in 1946. Shortage of labor has made it impossible for land-managing agencies to conduct control operations except on limited areas.

The Forest Service cooperated in extensive surveys of the Engelmann spruce type in Colorado and most of the spruce areas have now been given at least a general examination during the past 3 years. Serious infestations of the spruce bark beetle were found on the Holy Cross, Montezuma and San Juan National Forests in addition to the four (White River, Grand Mesa, Routt and Uncompahgre) previously reported. Over 75 percent of the merchantable volume of spruce has been killed on the White River National Forest and on much of this forest the loss is nearly 100 percent. The total loss in Colorado is now estimated at over 3 billion board feet, two thirds of this loss occurring in 1944 and 1945. There are still many very extensive stands of spruce where there has been little or no loss thus far. These stands should be watched very carefully so that control measures may be applied as soon as any infestation occurs.

Gypsy Moth Control by Aerial Spraying: A great amount of effort was given to improving gypsy moth control practices through the aerial application of DDT. This work formed the basis for an extensive control program which was carried out in the spring of 1946 when approximately 125 square miles of infested woodland was treated by the Bureau, with excellent results.

Insect Vectors of Forest Tree Diseases: Large scale tests have been made with DDT sprays for preventing feeding by insects that act as vectors of the Dutch elm disease and the phloem necrosis disease of elm. Sample plots were sprayed at various intervals throughout the season and records were kept of the insect populations present on the trees. It is believed that valuable street and shade trees can be protected at a fairly moderate cost.

Insects Affecting Forest Products: DDT as a 10 percent solution in petroleum oil has proved to be the most effective material tested thus far for preventing attack by ambrosia beetles and other insects in freshly cut green logs. This has been a very important problem, especially in the South, where it is often necessary to leave green logs and pulpwood exposed to insect attack during the summer months.

Solutions of DDT in petroleum oil that were used in treating wood, plywood and fabrics exposed to termites proved effective in giving protection against termites but not decay nor marine borers or fouling organisms. Water suspensions of DDT in insulating boards have been under test for one year.

Tests of copper compounds and phenol formaldehyde plastics, etc. have proved to give protection to timber - such as might be used for ammunition boxes or in ship building - from termites, decay and marine borers.

### 3. Truck Crop and Garden Insects

Need for solution of insect problems involved in production of sugar beet, onion, and cabbage seed: To meet the situation certain activities were curtailed and work was initiated in widely separated localities on insects affecting these crops. The results of this work have been gratifying. A control for the major pests of the sugar beet seed crop has been adopted commercially. Onion seed production has been increased by the application of new control measures. The major insect problems in the production of cabbage seed are still unsolved.

The pea aphid becomes more destructive especially to the pea crop in the Northwest: During the season of 1945-46 some of the work on the pea weevil was curtailed in order to give some attention to the pea aphid problem. DDT has given the most promising results against this insect of any material tested to date. However, it can not be recommended until the effect of feeding pea vines treated with this material to livestock has been fully evaluated.



Efforts have been concentrated on the development of DDT as an insecticide for the tomato fruitworm and an article on the results of this work has been issued for the benefit of the tomato growers, particularly in southern California. During the course of the investigations on the tomato fruitworm remedies were also developed for the tomato hornworm, tomato russet mite, ground beetles, and other insects which attack tomatoes. An all-purpose remedy, similar to the one which has been developed for tomatoes, is in prospect for the control of bean insects in the eastern states.

An acceptable rotenone insecticide for the Mexican bean beetle has been discovered: This makes it possible to concentrate on the finding of a single remedy which will protect the bean crop from damage by the corn earworm, red spider, and leafhopper. A combination of rotenone, sulfur, and DDT appears to be the answer to the problem. A schedule of application for long season growing bean crops remains to be worked out.

Potato insects: The performance of various formulas containing DDT was evaluated by working closely with State entomologists and tentative recommendations were made to the growers as to the use of this material on table stock potatoes. Growers in the Yakima Valley who have followed the spray schedule developed for the prevention of flea beetle damage to potato tubers have found it profitable. However, outbreaks of aphids during the past season have complicated the problem and efforts are now being made to find a successful method of combating these pests which are carriers of devastating potato diseases. In Nebraska, studies on the relation of temperatures to psyllid populations as an index to control operations have been completed and a new line of work has been initiated on methods of destruction of cull piles of potatoes which accumulate in vast quantities over the potato-growing areas and serve as an excellent breeding place for early psyllid populations.

DDT protects sweetpotato storage: Sweetpotato weevil investigations place emphasis on cleansing storage houses and banks of the weevils by the use of DDT. The indications are that further experimentation will show that this method may be instrumental in deweeviling the areas where sweetpotatoes are commonly stored.

Insecticidal residue problem: Applying insecticides poisonous to man on leafy vegetables, such as cabbage, as the crop nears the harvesting stage involves a risk to the grower and consumer. However, the work on cabbage caterpillars is rapidly approaching the stage where recommendations can be made which will protect the crop from insect damage and not involve a risk of contamination. This result has been reached by the development of non-poisonous insecticides and a study of the crop growth in relation to that part of the plant that goes to the consumer. New insecticides and methods of applying insecticides have been tested.

One of the outstanding features of this work has been the incorporation of a killing agent with a gas confined in a high pressure tank. When released the insecticide is delivered to the crop as a fine mist (aerosol). Experimentally the adaptation of this method of applying insecticides to

pea fields has been accomplished. A cheaper nonpoisonous gas in which to incorporate the killing agent is needed as well as the perfection of some engineering features of the delivery apparatus.

Soil fumigants aid in wireworm control: Crop losses from wireworms are : being gradually overcome through the application of soil fumigants and the practice of following with crop rotations. More effective soil fumigants and methods of applying them have been found. The incorporation of DDT or benzene hexachloride in the soil may be the ultimate solution of the wireworm problem.

Tobacco leaves free of undesirable deposit after effective treatment is the goal of present investigations on tobacco insects: Lead arsenate is a good remedy for some insects which attack tobacco, but it is undesirable from the standpoint of the discoloration of the tobacco and also its poisonous nature. Cryolite is a fair substitute for lead arsenate, but it does not meet all the necessary features of a reasonably good insecticide for use on growing tobacco. Against stored tobacco insects an experimental machine for delivering pyrethrum-oil sprays in storage houses has been developed and it appears that this development will more effectively control stored tobacco pests at less cost than any method used heretofore.

Value of investigations on truck crop and garden insects: During the war period the estimated need for rotenone insecticides, which are a development under this item, was 37,237,500 pounds of rotenone dust mixture, or sufficient to treat 5,447,500 acres of vegetables. According to the records of the Food and Drug Administration there has been no interstate shipment, during the past several years, of vegetable produce contaminated with insecticidal residues.

#### 4. Cereal and Forage Insects

Growing promise in development of insecticides and insect-resistant varieties of crops: There is considerable promise that new organic insecticides, such as DDT, and the breeding of insect resistant varieties of crops may provide effective and practical means of controlling some of those insects which up to now have had to be dealt with largely by means of cultural practices. These developments are reflected in many of the following activities:

Chinch bug: Except in local areas in Illinois and Nebraska, the 1945-46 overwintering population of bugs was low and serious losses from this pest did not occur in 1946.

DDT dust mixtures and improved hydroformers bottoms have been determined to be possible substitutes for coal tar creosote as chinch bug barrier materials.

Corn Earworm: Oil sprays containing DDT were very promising when applied to the silks for control of the earworm in corn grown for seed and possibly in canning and market sweet corn.

High resistance to the earworm is being obtained in several inbred selections of corn. When crossed with susceptible inbreds certain of these inbreds greatly decreased earworm damage to the progeny. This work is conducted in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering. Many additional inbreds, hybrids and varieties of field, sweet and popcorns are being tested to discover better sources of earworm resistance and their utilization in the corn improvement program.

Further work is needed on reduction in cost of application of insecticides and their adaptation to use on canning and field corn.

European Corn Borer: This insect spread into relatively little new territory in 1945. However, populations of the borer were higher in 1945 than in 1944 over the greater portion of the Corn Belt, and total losses caused by it in 1945 were estimated to be about \$37,000,000.

DDT micronized on fuller's earth in spray suspensions gave the highest control of the corn borer of any materials tested: Promising results in corn borer control have been secured with reduced numbers of applications of DDT, using either ground or airplane equipment, and it is indicated that the insecticidal control of this insect on canning and field corn may become practical.

The colonization of six species of parasites of the European corn borer in the United States in 1945, secured from domestic collections or through the courtesy of the Canadian Science Service, brings the total numbers released in this country since the inception of this work to almost 7,000,000. They occur in considerable abundance in various locations in the infested area, parasitism being particularly high in the Eastern States, and initial establishment of most of them has been attained in the more recently infested portions of the Corn Belt.

Grasshoppers: Although cool wet spring weather in 1945 caused the greatest retardation of grasshopper development ever recorded in the Great Plains areas, serious infestation persisted in many localities.

The efficiency of poison bait for grasshopper control in irrigated alfalfa was increased at least 20 percent by new formulas. Continued investigations during the past several years have substantially reduced the cost of bait per acre through the development of cheaper bait materials and more efficient equipment for mixing and applying them.

Excellent protection from insects attacking stored grain and milled cereals results from fumigants: A series of tests was conducted with new grain fumigants, with good results. As an example, wheat stored in steel bins and wooden farm granaries was protected by the new mixtures and a very heavy initial infestation of stored grain insects in a series of farm bins was reduced to a negligible amount for 2 years by an annual fumigation in August.



Several fungicides prevented insect infestation of seed grain from the outside when mixed with the grain. When DDT was incorporated with the fungicides infestation already present in the grain was also controlled effectively.

A suspension of DDT in water proved satisfactory to kill residual insect infestations in railway box cars intended for carrying flour. DDT was the most effective of many materials tested for interior wall treatments of wooden farm granaries to reduce residual insect infestations, applied either as a solution, oil emulsion or water suspension. Bagged wheat treated with DDT was protected from insects when exposed to infestation for 1 year. Cotton flour bags dipped in solutions of DDT in carbon tetrachloride gave excellent protection to flour stored in them for 6 months.

Experimental treatments of food package wrappings with DDT gave excellent protection of the contents and considerable promise that a safe and commercially practical way of applying this method may be found.

Hessian Fly: Infestations were rather spotty at harvest time in 1945 throughout the winter wheat belt, with moderate to heavy infestations reported from Nebraska, Kansas, Oklahoma, Kentucky, Tennessee, New Jersey and Virginia.

Further advancement toward commercial release was made in the breeding of many lines of hard and soft red winter wheats highly resistant to hessian fly. This work is conducted in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering and appropriate State agencies. In 1945 and 1946, extensive plantings of the semi-resistant variety Pawnee, developed by the Department and the Kansas State Experiment Station, have been comparatively free from infestation in central Kansas where standard varieties were moderately to severely infested. Several barley varieties subjected to severe hessian fly infestation in greenhouse tests were distinctly fly resistant. The breeding and selection of agronomically desirable winter wheats and barleys having high resistance to hessian fly and the common fungous diseases, in cooperation with the Federal and State agronomists and plant pathologists, is now being given special attention.

Losses from Legume Seed Insects still high: Losses of alfalfa seed caused by Lygus and related sucking bugs in 1945 were about \$563,000 in Maricopa and Yuma Counties, Arizona, alone. The average abundance of Lygus on first crop seed alfalfa at Delta, Utah was the highest on record.

DDT was determined to be an effective and practical insecticide for control of the vetch bruchid and alfalfa seed insects without adverse effects on honeybee populations when properly used. Infestations of leafhoppers, alfalfa weevil, thrips and aphids in seed alfalfa were also controlled effectively with DDT.

Insects Attacking Forage Crops: Department and State agronomists have found additional strains of alfalfa resistant to the pea aphid for possible use in the alfalfa improvement program being conducted. DDT has shown promise in foliage treatments for the control of leafhoppers on peanuts and alfalfa, thrips on seedling peanuts and the corn flea beetle on seedling corn.

Poison baiting of Mormon Cricket: With the successful development of a very cheap and effective control method, attention has been turned to the possibility of preventing potential general outbreaks by locating critical breeding areas and applying control measures on those restricted locations, including the possible use of one or another of the new organic insecticides.

Losses by Sugarcane Insects heavy: A loss of 138,000,000 pounds of cane sugar, valued at over \$6,000,000 was estimated to have been caused by the sugarcane borer in Louisiana in 1945. The West Indian sugarcane fulgorid was found in 4 new locations in Mississippi and the West Indian sugarcane mite was more generally distributed in the Lake Okeechobee section of Florida than at any previous time. Injury by the sugarcane beetle was very light in Louisiana in 1945 and the yellow sugarcane aphid was much less numerous than during the previous two years.

Cooperative work is being continued on the testing of cane varieties for borer resistance and the utilization of this resistance in the sugarcane improvement program, on insecticidal control with ground and airplane equipment using new organic compounds, on the determination of the distribution and abundance of sugarcane insects in the Gulf States and on insecticidal control of soil insects associated with root rot of sugarcane.

Sugarcane variety C. P. 34/79, which has shown high resistance to the borer in Louisiana and Florida, has been released by the plant breeders for commercial use in Florida.

Parasitization of the sugarcane borer by imported parasites resulted in low borer infestations in the Iellsmore, Florida area. Certain dust mixtures have shown promise for control of this borer.

White Grub: Cultural methods such as pasture land renovation and crop rotations have been developed that provide some measure of protection from infestation by these insects. Practical insecticidal methods for the control of this insect in lawns and golf greens are available, but they have not been found to be practical for use in field crops and pastures. In view of the long-time and extensive investigations that have been in progress on this problem without developing satisfactory control procedures or promising leads for exploitation, studies on this project have been much reduced. Current studies are confined mostly to observations and contacts to maintain current information on the abundance, distribution, and importance of white grubs and to find possible lines for development of better control measures through cultural procedures and use of new insecticides that are becoming available.

Damage by White-fringed Beetle heavy: More extensive damage to crops, including cabbage, lettuce and tobacco, was caused by the white-fringed beetle in North Carolina in 1945 than in any previous year. Extensive distribution of the beetles has been discovered in Georgia, where they are now causing serious losses or are a potential menace to nursery stock, newly planted orchards and field crops.

The use of DDT as a soil insecticide has shown promise of becoming an effective and practical means of control for use by farmers. Benzene hexachloride has also been very effective in experimental trials. Further investigations will emphasize the development of insecticidal and cultural control measures suitable for farmer use.

### 5. Cotton Insects

The necessity of facing new research problems as they develop each year often requires that work on other studies be discontinued: Investigations regarding the use of DDT, benzene hexachloride, sabadilla, nicotine, and other organic materials that may be of value in the control of cotton insects have been undertaken during recent years. Phases of cotton insect research that have been completed or postponed include investigations of the: (1) control of the boll weevil and other insects attacking sea-island cotton; (2) native parasites of the boll weevil; (3) rearing and establishment of introduced foreign parasites of the pink bollworm; (4) *Thurberia* weevil; (5) cotton leaf perforator; and (6) control of the boll weevil and other insects in the hill sections of Mississippi.

Many progressive farmers testify that the use of control practices developed by this Bureau has saved them thousands of dollars and increased their yields by hundreds of bales in a single season. Emphasis has been continued on lines of research to simplify and improve the known methods of cotton insect control and to develop new methods that will be more economical, more effective, or have greater appeal to growers.

For many years this Department has recommended early fall destruction of cotton stalks as a practical method of boll weevil control: Its value has again been demonstrated in connection with the campaign against the pink bollworm. All cotton in the lower Rio Grande Valley of Texas was cut before August 31, 1945. The growers gave excellent cooperation and weather conditions were favorable for early maturity of the crop as well as for the clean-up during August. Last spring (1946) both the boll weevil and pink bollworm populations were very low and the growers have obtained the largest per-acre yield of cotton ever produced in the Lower Rio Grande Valley.

At Florence, S.C., basic copper arsenate compared favorably with calcium arsenate for boll weevil control. This is important because preliminary experiments indicate that basic copper arsenate is not as injurious as calcium arsenate to crops growing in the light, sandy soils of that area.



Tests indicate that DDT is not nearly as effective against the boll weevil as calcium arsenate, but that the new organic insecticide, benzene hexachloride might be more effective than calcium arsenate. In the preliminary tests benzene hexachloride was not only more toxic to the boll weevil than calcium arsenate, but it also was more effective against the cotton leafworm, and was equal to or better than DDT against the cotton flea hopper, tarnished plant bug and green stinkbug.

DDT more effective against the pink bollworm in preliminary tests in 1944 than any of the many insecticides tested against this insect;

DDT was tested on a more extensive scale during 1945 and 1946. The pink bollworm populations were reduced by from 65 to 95 percent by the application of 7.5 to 15 pounds per acre of technical DDT applied throughout the season either in a spray or dust, the degree of control increasing with the quantity of DDT used. Studies are being made with benzene hexachloride and other new organic insecticides in the hope of discovering a material that is even more effective against the pink bollworm than DDT.

Research relating to the practical use of DDT against the pink bollworm is now being conducted in the vicinity of Torreon, Coah., Mexico, where the pink bollworm infestations are much higher than at any place in the United States.

Research has shown that the pink bollworm varies in its habits and behavior in different environments. Some of the control practices based on studies made in the Presidio area are of little or no value in the lower Rio Grande Valley, where the pink bollworm does not go into the soil to pupate or to hibernate and where the winter temperatures seldom fall below 30° F. This ability of the pink bollworm to change or vary its habits to fit its environment makes it important to conduct investigations in each area where it occurs. Studies have been largely completed or discontinued in the Presidio Valley and are now being conducted in the Lower Rio Grande and El Paso Valleys.

The bollworm continues to be the most difficult of the cotton insects for the average farmer to control, but progress is being made. Research in recent years has shown that several insecticides can be used effectively against the bollworm but only if they are properly applied while many of the worms are small or still in the egg stage.

Although the use of DDT, tested and found effective in 1945 for the control of the cotton flea hopper and related insects is a very important discovery, it appears from recent experiments that benzene hexachloride may prove to be equally or more effective. It has been found that DDT is like calcium arsenate and other arsenical insecticides in that its use is likely to be followed by injurious cotton aphid populations.

## 6. Bee Culture

In the calendar year 1945 the beekeeping industry produced 233,000,000 pounds of honey and 4,500,000 pounds of beeswax. The number of colonies was 5,460,000. In excess of 1,227,000 pounds of package bees and 874,000 queen bees were produced and shipped from point of origin. However, pollination remains the most important contribution of the industry to our agricultural economy. While other insects, such as the bumblebee, are of value in the pollination of specific crops, the honeybee is the only all-around pollinating insect and the only insect that can be procured in quantities as needed and placed where needed when needed.

Bee diseases and poisoning cause heavy loss: Diseases of brood and of adult bees, as well as the poisoning of bees, cause an annual loss to beekeepers in excess of \$4,000,000. The destruction of bees by such causes means not only curtailment in the production of honey and beeswax but also occasions a reduction in seed and fruit crops from insect-pollinated plants serviced by the pollinating activity of bees.

The development of strains of bees resistant to American foulbrood, the most serious bee disease in this country, is advancing at a satisfactory rate; now that full control over the mating of queen bees used in the breeding work has been made possible through the improved technique for their artificial insemination worked out within the Bureau. Two hundred and thirty-six queens of resistant stock were reared and sent to cooperating agencies.

Investigations on the use of chemicals to check American foulbrood have shown that, in laboratory cultures, sulfathiazole and penicillin have a definitely retarding effect on spore germination of Bacillus larvae, the causative organism of the disease.

Work was completed on a simple, speedy field test for American foulbrood and a description of the method published. The test should result in better disease control since it enables the State inspectors and others to make definite, on-the-spot determinations easily, economically and without the delay necessary when samples are sent to Washington for a laboratory diagnosis.

Bee poisoning by DDT and other insecticides investigated: Field studies on bees placed in or near cotton fields in Texas that were dusted with DDT indicated that the field application of this insecticide, when applied in amounts no more than are needed to control injurious insects and on plants that are not in bloom, will have little or no injurious effect on honeybees. Observations on colonies in extensive acreages of orange groves in California that were heavily dusted with DDT likewise failed to reveal any serious effect on the bees. On the other hand, benzene hexachloride proved exceedingly toxic to bees under laboratory conditions.

Artificially inseminated queens rival naturally mated queens: Work on improving the technique for the artificial insemination of queen bees

was discontinued, the Bureau having developed a method under which artificially inseminated queens are now being produced which prove just as good in tests on honey production, disease resistance, and other factors as do naturally mated queens.

Bee Management: Colonies in Wisconsin fed from February 20 to the middle of April, 1946 on soybean pollen-supplement cakes made according to the formula developed in the Bureau, reared an average of 10 pounds of bees during this period. This permitted the removal of an average of 2-1/4 pounds of package bees per colony while a sufficient population was left to build into good producing colonies.

Pollination experiments conducted The intrinsic nature of insect pollination can be realized by mentioning a few of the 50 agricultural crops that have been found to require such pollination. They include most of the deciduous fruits, most of the bush fruits, such fruits as grapes and melons, and such important seed crops as alfalfa, most of the clovers, cabbage, cauliflower, brussel sprouts, turnips, cotton, etc. In the case of alfalfa seed, and essentially of most of the clover seeds, the production per acre has gradually decreased over a long period of years. The decline has coincided with the destruction of many native pollinating insects upon which pollination once depended. Their decimation has been brought about by modern agricultural practices, such as clean cultivation, the use of insecticides, planting enormous acreages of single crops, brush fires, elimination of wood lots, etc.

The greater attractiveness of "competitor" plants as regards visits by honeybees often interferes with a successful set of seed or fruit by various plants even when bees are obtained especially to pollinate them. Success in training bees under laboratory conditions to visit feeders or blossoms at the will of the investigators has led, consequently, to studies on the practicability of directing bees to desired plants under field conditions where the factor of competitor plants prevails. This is of special importance, for example, in attempts to produce alfalfa seed in the presence of sweet clover and certain other plants. No conclusive results have yet been obtained from these experiments.

## 7. Insects affecting man and animals

Mosquitoes, sandflies, and other gnats affecting man and animals: The mosquitoes of the States of Oregon, Idaho and Washington, also Alaska have been rather fully studied and information on the species inhabiting these areas, their habits, distribution, and biology will be published. Methods of control for the two more pestiferous floodwater species along the Columbia River have been fairly well established including the efficacy of some of the newer insecticides such as DDT and benzene hexachloride. In studies on repellents, two materials have been found which will give protection against these two species and also the common malaria vector of the region, for 350 minutes or more. Aerosol fog generators using DDT as a larvicide were found to be effective for killing floodwater mosquito larvae when atmospheric conditions permit the laying-down of the fog on the water surface.



The current program includes:

- (1) The testing of large numbers of chemicals and their method of application for the control of salt marsh mosquitoes and other species annoying to mankind.
- (2) Curtailment to a considerable extent of the investigations on floodwater mosquitoes of the Northwest and undertaking studies on irrigation mosquitoes which are a problem to certain areas in the Pacific Northwest and which will become increasingly so due to irrigation projects which are under way in that region.
- (3) Beginning investigations on the control of mosquitoes in Alaska as these may affect agricultural developments in the Territory.
- (4) Continued investigations on mosquito repellents with special reference to those which can be applied to clothing to give longer lasting effect than those applied to the skin.

DDT effective against sandfly: The principal accomplishment this year on sandfly control was the demonstration at Savannah, Georgia, that satisfactory reduction in annoyance from these insects can be obtained by area applications of DDT insecticide and its application to local hiding places. The methods are limited to special conditions.

Buffalo gnat control through use of heat-generated aerosols and airplane spraying of DDT not successful: Observations were made on the effectiveness of heat-generated aerosols and airplane spraying of DDT to reduce the number of buffalo gnats attacking livestock in certain localities in Texas. The methods used were not outstandingly successful for the control of the pest.

The current investigations on these insects are at present limited to a study of those species which occur in Alaska. Some incidental observations will be made on their control in the United States.

Methods for destroying ticks affecting man and animals appear promising: Applications of DDT to cattle, and airplane applications of the same material to infested pastures indicate that these treatments may be feasible in connection with the eradication program of the Texas fever tick.

A fairly good remedy for applying to the ears of susceptible animals has alleviated the degree of infestation by the Gulf Coast tick.

Studies on the control of lone star tick (*Amblyomma americanum*) and American dog tick (*Dermacentor variabilis*) indicates that one to four pounds of DDT per acre applied either by airplane or ground dusting equipment will give a fair degree of control of these species.

DDT dusts were found to be effective in controlling the brown dog tick in houses.

DDT mixed with soluble pineoil has given good results in the control of the winter horse tick.

Extensive studies are under way to find more effective tickicides, tick repellents, and the possibility of pasture management for the control of ticks which affect man and animals.

Emphasis directed primarily toward killing the larvae of cattle grubs in the backs of the animals, benzene hexachloride apparently giving better results than rotenone-bearing products: Methods for applying rotenone and other insecticides against cattle grubs have been increased in efficiency.

In order to improve present methods of cattle grub control, the current program involves investigation of the possibility of chemotherapy whereby the larvae may be killed in the host before they have damaged the skin of the animal. Very promising leads for a treatment of that kind have been obtained with some of the therapeutic drugs already in production. Considerable emphasis will also be placed on perfecting methods of applying insecticides by mechanical means and a study of the application of these methods as they may be used in various parts of the United States.

Formulations of DDT tested to determine its efficacy in the control of lice affecting livestock: Certain concoctions have proved effective in treating both sheep and cattle for the control of lice either as a dust, spray, or dip. Further studies are required, however, to determine the best methods of application and dosages that will best fit conditions in different parts of the country.

A promising material known as hydroxy methyl flavan has given fair results in preliminary tests on the area control of chiggers. This material and others will be tested further.

Other materials studied to take place of "Smear 62" for the treatment and prevention of screwworm infestations in livestock: Due to the sudden scarcity of one of the ingredients in Smear 62, it has been necessary to study other materials to take the place of this remedy. Investigations along this line have developed several materials which appear to be as good or better than Smear 62.

Studies have been conducted to assist ranchmen in modifying animal husbandry practices in order to reduce losses occasioned by the flies.

Extensive surveys are made each year to determine the line of migration of the flies from the overwintering area, its relative abundance in areas normally inhabited and to advise stockmen of precautions and remedies to use in preventing the attacks of the insects.

Sprays containing .2 to 2-1/2% DDT have given spectacular results in controlling horn flies on beef and dairy cattle: Large-scaled tests involving approximately 100,000 animals have been conducted and it is indicated that this relatively inexpensive treatment will result in the saving of several million pounds of beef annually, and in materially increasing the amount of milk produced by dairy cattle.

The use of DDT sprays about dairy buildings when applied to the structure itself, practically eliminates trouble from the various species of flies which are annoying to dairy cows. Continuation of studies of flies which attack livestock involves the development of better remedies for the prevention of screwworm infestations and other methods for their control, investigations on more efficient means of applying dusts and sprays for the control of horn flies and stable flies, and more detailed investigations on the dosages required for adequate control of these pests in various sections of the United States.

Studies are being conducted on the proper method of using DDT for the control of certain household insects: Studies have also been conducted to develop better methods of mothproofing fabrics to prevent damage from carpet beetles and clothes moths.

An interesting development in the prevention of moth and carpet beetle damage to fabrics is the effective treatment with DDT of wool and mohair stored in warehouses and also studies which have been made on the effect of dipping animals in DDT formulations to determine how long the fibers from these animals would be resistant to these insects. It has been found that such fibers are immune to damage for several years after the animals have been dipped.

#### 8. Insect pest survey

Summaries of current information on the occurrence, distribution and abundance of insect pests throughout the United States are prepared and distributed to those concerned with insect control, including State workers, insecticide manufacturers and distributors, and others: During the fiscal year 1946, there were issued 7 monthly and one annual statement summarizing the current status of the more important insect pests, 12 weekly statements of the status of fruit insect pests that require nicotine for their control, and 7 Special Supplements to the Insect Pest Survey. These summaries, the purpose of which is to aid in protecting agriculture from established or new pests, are useful to the State workers in planning control operations, estimating needs for control materials, and advising farmers or county agents of impending outbreaks. They also serve to aid the industry in distributing supplies of insecticide materials, especially those that are in short supply, to areas in which they are most urgently needed to protect crops from insect losses. Approximately 3,500 reports received during the year from State collaborators and Bureau personnel served as the basis from which the summary statements were prepared. These, together with about 15,000 additional reports available through foreign plant quarantine work in connection with a special survey conducted around ports, were abstracted and placed in the files of the Insect Pest Survey, where they provide a permanent reference of the



distribution, food plants, and importance of each insect species reported upon. Records added during the year included 200 genera and 700 species of insects not previously on file as occurring in this country. Data on file were utilized during the year in providing information in response to approximately 118 requests concerning the distribution, host plants, and abundance of various insects.

The value of the information compiled and disseminated by the Insect Pest Survey is largely dependent upon the extent and quality of the cooperation received by collaborating agencies. Efforts are being constantly directed towards means of securing more satisfactory basic reports on insect observations and in obtaining better coverage of the entire country and particularly of critical areas from the insect pest standpoint.

#### 9. Identification and classification of insects

This project has as its objectives (1) the identification of insects and allied organisms for the quarantine, control and research activities of the Bureau of Entomology and Plant Quarantine, and also for the benefit of the military and naval establishments and other federal agencies, state agricultural colleges and experiment stations, pest-control operators and private individuals of the United States, as well as for foreign institutions and agencies, especially of the Western Hemisphere; and (2) the performance of continuing research in insect classification to provide the basis for definite and complete identification.

Approximately 700,000 different kinds of insects have been described and given scientific names. At least three times as many remain undefined and unnamed, and new species are being described at the rate of about 10,000 a year.

In order to incorporate newly discovered species, many of which prove to be serious pests, into existing schemes of classification, it becomes necessary to revise or completely rework published taxonomic papers. This means that the work done on this project is necessarily on a continuing basis.

During the fiscal year 1946, identifications were made and reported for 51,797 insect samples for units of this Bureau; for the Army, Navy, Public Health Service and other federal agencies; for agricultural colleges and experiment stations of every state, Puerto Rico, Hawaii, and Alaska; for individuals, private institutions and pest-control operators, and for foreign governmental agencies and institutions engaged in insect control. In addition, nearly 900 letters were prepared in reply to requests for information on broader questions of insect classification, for aid in problems of insect nomenclature, for biological, distributional and host data on particular species or groups, and for the review of manuscripts pertaining to insect taxonomy. Direct personal guidance with problems of insect classification was also given numerous outside investigators who spent periods of varying length in the Bureau.

Twenty-seven technical manuscripts totaling 780 pages were submitted for publication during the year. These manuscripts consist of synopses or revisions of subordinate groups, redefinitions of described species and descriptions of new species, in all the principal orders of insects. Such papers, when published, are accepted by entomologists throughout the world as representing authoritative opinions on the specific points treated.

#### 10. Foreign Parasites

Importations of natural enemies of insect pests during the fiscal year 1946 consisted of parasites of the boll weevil, vegetable weevil and armyworms.

Cotton boll weevil parasite shipments from Peru consisted of 15 consignments containing 13,862 adults of one species and 234 adults of another. These were forwarded for release in infested fields in Texas and adjoining states.

Vegetable weevil parasites imported from Argentina and Uruguay during the year comprised 4,702 cocoons of two species. In addition, an undetermined nematode was found to parasitize up to 78 percent of the larvae in some sections of Argentina, and 885 parasitized larvae, each containing 1-15 nematodes, were forwarded to the United States. All of this material was forwarded to the Citrus Experiment Station of the University of California for rearing and colonization.

Armyworm parasites shipped to the Florida Agricultural Experiment Station consisted of more than 7,000 cocoons from Uruguay and 1,825 adults of a coleopterous predator, from Argentina.

Parasites of the sugarcane borer shipped to the Puerto Rico Agricultural Experiment Station comprised 2,834 puparia of one species and small numbers of two others.

Importation of insect enemies of the Klamath weed from Australia has been continued. Four shipments comprised 33,000 adults and 2,000 larvae and pupae of two leaf feeders, and 1,473 larvae of a root borer. All of this material was received through the courtesy of the Australian Council for Scientific and Industrial Research. Methods were developed for breaking the temporary stoppage in growth of both species of leaf feeders, and feeding tests on cotton, tobacco, sweetpotato, flax, hemp and sugar beet were completed. No feeding or reproduction occurred on any of these plants. The first field releases of parasites were made in northern California early in 1945 and extensive releases of both species, totaling 19,000 adults, were made during the late summer of that year and the spring of 1946. Eggs and larvae of both species have been recovered in some numbers at several release points.

## 11. Control Investigations

New project undertaken at Beltsville, Maryland to study certain fundamentals relative to the treatment of commodities regulated by plant quarantines: The St. Louis laboratory was closed at the end of the fiscal year 1946, and such problems as will arise relative to treatments of commodities regulated by State quarantines will be studied at the Beltsville station. The results of the cooperative studies on oriental fruit moth, which were finished at St. Louis at the end of the fiscal year 1945, were submitted to the cooperating state and members of the Western Plant Board, and prepared in manuscript form for publication.

Emphasis was shifted during the fiscal year 1946 in the studies relative to treatments for products regulated under the white-fringed beetle quarantine from methyl bromide fumigation to an exploration of the possibilities of using DDT treatments as a basis for certification. The study of factors governing tolerance of nursery plants to methyl bromide fumigation was retained, however. It was found that injury resulting from methyl bromide fumigation was associated with the transpiration rate (water loss) of the plants during the first six hours following treatment. A low rate of water loss was associated with a high degree of injury, and a high rate with little or no injury. By regulating the factors which governed transpiration, the hazard of injury to plants was effectively reduced. This information has been put to practical use in the treatment of plants. All of the studies on soil fumigation were summarized and the results prepared in form to be utilized by the quarantine units; new schedules at various temperature levels replace the previous single schedule for straight methyl bromide and an entirely new series were prepared for the use of methyl bromide in an organic solvent, which simplifies the equipment and handling procedure necessary with straight methyl bromide. The provisional schedule for the fumigation of commodities which might carry eggs, such as hay and peanuts, was replaced by a graduated series of schedules for various temperature levels, and this problem terminated.

Emphasis in studies relative to treatments for commodities regulated by the Japanese beetle quarantine was placed in 1945-1946 on ridding airplanes of insects by use of insecticidal aerosols: In laboratory tests the effectiveness of several formulac against adult beetles was determined, then practical tests performed in various types of military aircraft. The quarantine unit was assisted in setting up the routine treatment of scheduled military flights on a trial basis to study the feasibility of such a program. At the close of the fiscal year 1946, tests were under way to explore the added value of a DDT residue in the plane cabins.

The cooperative studies with the Delaware Agricultural Experiment Station on the tolerance of apple varieties to methyl bromide fumigation were terminated with the second season's tests, and the results prepared for publication. The studies relative to treatments for commodities regulated by the gypsy moth quarantine were continued to further perfect the fumigation of Christmas trees and greens, forest and quarry products which has been applied by the quarantine unit for the past two years.



A new project to develop treatments for bulk cottonseed and other products regulated by the pink bollworm quarantine was begun early in the fiscal year 1946: At the end of the year it had been determined that fumigation with methyl bromide applied as a gas, or injected as a liquid into the load either undiluted or in an organic solvent, would kill larvae embedded in seeds located in all portions of the load, at dosages which did not cause reduction in germinating quality of the seed. Tests are under way to determine if any effect to cottonseed cake or oil is evident.

Methods of applying insecticides: Cooperative field tests were made against a number of insect pests which are the subject of investigations by various Divisions of the Bureau, to explore the possible use of heat generated aerosols for the control of any of these insects. Tests were made in the southwestern and western States in the fall of 1945 and spring of 1946 against various truck crop, cereal and forage, cotton, livestock and fruit insects.

Toxic effect of insecticides on insects: In the project on fundamental studies in insect physiology and toxicology, the initial phase of an investigation of the mode of action of certain arsenical insecticides was completed. During the year 1946, the next phase in this study of the mode of insecticidal action was completed and consisted of research to determine the relation between concentration of cyanide poison and survival time of treated insects. Also, the relation between concentration of applied DDT and survival time of treated insects was determined. Through the analysis of the data obtained in these experiments concepts were formulated that contribute to an understanding of the toxic processes that take place in insects poisoned by one of these insecticides. It is necessary that fundamental studies of this sort be in the form of long time projects in order that basic knowledge, required for an eventual understanding of the mode of action of insecticides, be obtained.

Seven thousand and sixty-two tests were made on new compounds, on improved combinations of insecticide and adjuncts, and on commercial samples to determine their insecticidal effect. Some toxicity to one or more species of insect pests was shown by 72 of the new materials tested. Notably effective against certain insects were gamma benzene hexachloride and certain rotenone bearing roots from Puerto Rico. Of the 223 samples tested for synergistic action with pyrethrins against houseflies, 22 showed an increase in insecticidal action when combined with pyrethrins.

Improvement in the insecticidal action of nicotine was sought in cooperative work with the Eastern Regional Research Laboratory. New derivatives of nicotine and new materials combined with nicotine were tested. Two materials, when combined with nicotine, showed a marked improvement in insecticidal effectiveness.

## 12. Insecticide and fungicide investigations

Public is informed of results of Bureau's work through publications issued by the Department or appearing in scientific journals: Six United States public service patents were issued to members of the Bureau in connection with work under this project. Two of these patents covered synthetic organic insecticides, 2 were for insect repellents, 1 for an anthelmintic, and 1 for scientific apparatus.

Investigation of the insecticidal constituents of pyrethrum continued: The partial synthesis of the various pyrethrins and cinorins was carried out and their effectiveness against houseflies was determined by the Bureau. The keeping qualities of highly purified pyrethrin concentrates have been investigated and their solubility in Freon-12 determined. Aerosols containing pure pyrethrins have been prepared for testing against houseflies in comparison with similar preparations containing ordinary pyrethrum extracts of 20-percent pyrethrin content.

Plants from various sources were prepared for tests to determine whether they possess insecticidal properties.

Work with DDT continued to be active. Study of the solubility of DDT in kerosenes from different sources showed that kerosenes derived from naphthenic base crude oils are better solvents than those derived from paraffinic base oils. Various solvents and emulsifiers were tested for the preparation of DDT emulsions for agricultural purposes. DDT powders were prepared for comparative tests by grinding the technical product with different inert diluents. It was found that wettable powders containing as much as 50 percent DDT can be produced simply by grinding with certain clays. The effect of ultraviolet light and sunlight on DDT deposits was investigated. Exposure of technical grade or pure DDT to ultraviolet light for 40 hours or sunlight for 3 months did not produce any effect, but exposure of DDT solutions to the ultraviolet irradiation caused marked decomposition. Exposure to sunlight and air for 64 hours of deposits of technical or pure DDT mixed with a number of inert powder diluents did not result in detectable decomposition.

Sensitive colorimetric method for the analysis of DDT developed and refined: This method can be used for the determination of minute quantities of the insecticide in a variety of materials such as insecticide mixtures, plant and insect tissues, water, milk, butter, and animal organs and tissues. Using this method, a cooperative study is in progress on the secretion of DDT in milk and in body tissues of cattle fed on DDT-treated hay. Samples of many varieties of vegetables grown in soil treated with DDT have been analyzed but no significant amount of DDT has been found in any of them.

In cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering, samples of washed and unwashed apples which had been treated with DDT have been analyzed. Washed and unwashed samples of grapes and of bell and chili peppers treated with DDT also were analyzed. Experiments on machine brushing of apples showed that this treatment does not remove DDT residues but merely tends to level off the residue load on fruit of a given lot.

About 150 organic compounds of different classes have been synthesized and prepared for testing as insecticides and pyrethrum synergists and as repellents for insects, especially mosquitoes. Larger quantities have been prepared of compounds which showed promise in preliminary tests.

Progress has been made in determining the chemical nature of the sex attractant secreted by the female gypsy moth. The attractant material from 200,000 moths was hydrogenated and prepared for use in trapping.

Improved baits for the Oriental fruit moth were developed.

Work is in progress to develop suitable formulations and equipment for aerosols for the control of insects attacking field and greenhouse crops.

More extensive field tests with the blower applicator developed for hydrocyanic acid fumigation of citrus to control the California red scale showed that somewhat better results were obtained with this applicator than with the ordinary commercial applicator. Equipment has been devised to remove residual gas from the gastight tents at the end of the fumigation period in order to eliminate the hazard to the operators.

Approximately 2,000 samples of insecticide materials and products containing insecticide residues were analyzed at Beltsville during the fiscal year 1946. Many analyses also were made at other field stations. These analyses have been essential in guiding the field research of the Bureau and in determining residue hazards from various materials, schedules and formulations.



(b) Insect and Plant Disease Control

Objective: In cooperation with States, to protect American agriculture from destructive insect pests and plant diseases by the application of control measures directed at eradication, suppression or prevention of spread, depending upon the degree of risk involved, the source and extent of the infestations, and the effectiveness of available control measures.

The Problem and its Significance: Control programs currently receiving attention include insect pests or plant diseases falling into two general categories (1) those involving the eradication, suppression or prevention of spread of introduced pests that have become established in limited areas and threaten to spread to other parts of the country and (2) those of more general distribution which can be more effectively and economically controlled by Federal, state and community action than by individual farmers. The principal pests dealt with under this appropriation are the Japanese beetle, the sweetpotato weevil, the Mexican fruitfly, the Gypsy and brown-tail moths, the pink bollworm and Thurberia weevil, all of which are serious insect pests, and the injurious plant diseases known as Dutch elm disease, phony peach, peach mosaic, and black stem rust of wheat. All of these pests, if uncontrolled, are capable of taking an exceedingly heavy toll in annual damage to agricultural products and forests and affect crops of great importance. Control of these pests not only reduces or eliminates the losses caused by them currently, but prevents future damage over much larger areas. The problem is peculiarly difficult in that while safeguards must be provided against the spread of these various pests, they must still permit, to the greatest extent possible, the movement of agricultural products which are badly needed in areas where they are not grown and on which thousands of producers depend for a livelihood.

General Plan: Immediate responsibility for the Bureau's program of work under this appropriation lies with subject-matter control divisions which are strategically located so as to deal most effectively with the various pests. These divisions are Japanese Beetle Control, which conducts operations also against Dutch elm disease; Domestic Plant Quarantines, which conducts activities against sweetpotato weevils, phony peach, and peach mosaic, and the transit inspection work carried on at principal distribution centers throughout the country; Gypsy Moth Control; Mexican Fruitfly Control; Plant Disease Control, which directs barberry eradication work to prevent black stem rust of wheat; and Pink Bollworm Control. In all of these control programs substantial cooperation is supplied by affected states and in some instances by counties, municipalities and other public agencies. The Republic of Mexico cooperates in the control efforts directed against the pink bollworm and the Mexican fruitfly. The actual work programs in these various fields necessarily differ quite widely.

Examples of Progress and Current Program in the several financial projects follow:

## 1. Japanese Beetle Control

Movement of plants under certification increased: Although the extension of the regulated area during the fiscal year 1946 was very slight, with the discontinuance of war hostilities there was a marked increase in the movement of plants, 109,000,000 plants being certified for shipment as compared to 63,948,180 in 1945.

Shipments certified on basis of treatments developed by research are lightening the task of inspectors and providing safe treatments which became popular with nurserymen: Without these now treating schedules and methods it would have been impossible for inspectors to keep current on shipments requiring attention. The movement of nursery stock continued heavy through the year. More than 1,350,000 plants were treated for shipment in June 1946, compared with 26,517 in June 1945.

Changed nursery practices: An important development in connection with the regulatory work associated with nurseries has been the steps taken by the operators to control beetles on their properties by the use of DDT insecticides. The benefit the nurseryman gets in protecting his stock is becoming generally recognized and is desirable from all points of view. This practice, however, complicates the work of the inspector as it necessitates a closer check on all properties to determine the type of treatment that may be required to assure that stock offered for shipment is free from infestation. The difficulty of classifying the establishment is increased, which has a direct bearing on the inspection work load.

Likewise the more general acceptance of the use of the ethylene dichloride dip method of treatment as compared with that of fumigation by methyl bromide increases the burdens of inspection.

### Farm Products Inspection:

Quarantine regulations provide safeguards to prevent spread of beetles through the shipment of fresh fruits and vegetables: Plans for this year were based on handling approximately the same number of shipments as during the fiscal year 1945 when 3,972 carloads and truckloads of fresh fruits and vegetables were certified for shipment to destinations in nonregulated areas. Most of these were fumigated under supervision with methyl bromide in advance of certification.

Vehicular inspection: The inspection of vehicles is generally limited to the summer season. The activities may be divided into two sections based on the type of vehicle. One of these is concerned with checking of motor trucks on highways leaving the heavily infested area; the other is concerned with airplanes leaving airfields where heavy populations of beetles occur.

Highway inspection was carried on in Virginia and roving patrols were maintained. Three hundred and seventy-four of the 69,577 loaded trucks

stopped were carrying products moving in violation of the quarantine. Most of these were inspected and certified, eleven turned back and the produce disposed of within the regulated area. One dealer who deliberately violated the regulations was prosecuted and fined \$300. Empty trucks were examined and beetles removed and those containing debris which might harbor beetles were cleaned.

Airplanes carry beetles but gas-propelled aerosols prove effective: Through cooperative arrangements with Army and Navy officials, the clothing of personnel using airplanes leaving military fields within the heavily infested areas, was inspected as passengers and crew entered planes at loading time. A similar procedure was carried out with commercial airlines. With the commercial airlines, inspectors were stationed at more important airports to aid in the inspection of clothing of passengers and crews, inspection of baggage, mail, and other parcels as well as interior of passengers' cabins in order to remove beetles before loading.

Experiments and rather extensive operational tests carried out in cooperation with the Army demonstrated that gas-propelled aerosols were effective in killing the beetle and that they could be used without serious interference to airplane movement. To increase the effectiveness of the inspection procedure previously used, arrangements were made to treat parts of planes leaving airports where beetles were abundant in advance of departure during the 1946 season.

Trapping uncovers new infestations: Between 50,000 and 55,000 traps were used in the trap inspection program for the 1946 calendar year, the plan being to operate at least a few traps in every state outside of the regulated areas.

Traps were set in May in the southern areas and reports disclose catches of beetles at a number of new points. Some of these indicate establishment of infestation of some significance and in localities where inspections had not been made in previous years, for example Dahlonega, Georgia. Beetles have also been trapped at a number of airports.

States cooperate in soil treatment: In cooperation with the states soil treatment was applied to 555.25 acres at 41 locations in 9 states. In addition, a DDT insecticide was applied to 240 acres at Blowing Rock, North Carolina, as a continuation of the control program. The cooperating states fully recognize the value of applying suppressive measures to retard the development of infestations at isolated centers. Experimental work has developed that DDT insecticides may be used to treat soil at a cost less than that involved where lead arsenate is used. This may be expected to stimulate the states to extend the areas to be treated around points where infestation is established.

Experimental suppressive work at Blowing Rock, North Carolina, materially reduced the infestation at this point and demonstrated the



advantage of soil treatment supplemented by the application of LDT insecticides to the foliage to reduce populations of adults.

During the summer of 1946 DDT insecticides have been applied on a limited scale at some airports and around certain loading platforms where concentrations of beetles were heavy to secure basic information on methods of application. These applications have markedly reduced the number of adults and continued applications contribute materially to reducing the hazard of spread in such areas and supplement other procedures used to prevent artificial carriage of beetles into new localities.

## 2. Sweetpotato Weevil Eradication

The state quarantine established to cover the newly infested area in Colquitt, Tift, and Worth Counties, Georgia involves a number of certified sweetpotato growers with extensive plant distribution as well as sweetpotato producing farms. The regulations on Grady County involve primarily farms producing sweetpotatoes for stock feed. These quarantine requirements prevent production on and within a mile of all infested farms. Continuous inspections have been in progress to keep farms free of all volunteer plants and bedded sweetpotatoes in order to starve out the weevil. One hundred and twenty-nine infestations were found in the fall of 1945, involving an annual production of plants and potatoes valued at one and one-half million dollars. Eleven additional infestations were found during the spring of 1946.

The six new infestations found in West Feliciana Parish, Louisiana, which is an important center for production of seed sweetpotatoes, particularly of new varieties have been placed under state quarantine. Drastic measures have been carried on in cooperation with the State to suppress the weevil on farms in St. Landry and adjacent parishes in Louisiana where extensive infestations have become important in weevil spread due to increased production and wider distribution. This area produces a large percentage of all market sweetpotatoes grown in the South.

Seedbed, as well as field inspections, for volunteer plants have been intensively prosecuted since the early spring of 1946 in new areas as well as those in which eradication work had previously been done. The states have contributed to the program in the same manner as in the past.

## 3. Mexican Fruit Fly

Sterilization of citrus fruit accepted by the industry in the regulated area as the best and cheapest method to prevent the spread of the Mexican fruitfly to uninfested areas: On account of the finding of infested fruit, sterilization of grapefruit this past year started on March 6, 1946, and because of the rapid increase in larval infestations all grapefruit was required to be sterilized before shipment on and after April 15. Although the increase in the number of infestations was small, the amount of fruit sterilized before shipment was almost twice the amount treated during the previous season.

During the fruit harvesting season of 1945-46, 75,718.3 equivalent carlots of commercial fruit were produced. In the table below, actual production figures for the season 1942-43 through 1945-46 are given:

	<u>Equivalent Carlots</u>			
	<u>1942-43</u>	<u>1943-44</u>	<u>1944-45</u>	<u>1945-46</u>
Fresh:				
Rail .....	27,995.0	29,387.1	39,943.8	37,523.6
Truck .....	5,061.0	5,472.1	5,617.8	9,900.3
Express & Passenger Cars .....	920.0	1,160.0	900.0	1,372.0
Boat .....				133.2
Processed .....	20,388.0	23,147.0	26,773.3	26,789.2
Total carlots .....	54,364.0	59,166.2	73,234.9	75,718.3

It is estimated at the present time there are growing, within the Rio Grande Valley, approximately 10,000,000 citrus trees as compares with 7,500,000 in 1944. All of these trees require inspection. The fruit requires certification and in the case of grapefruit much of it has to be treated prior to certification. Manpower requirements for supervision of treatment are constantly increasing. During the next season there will be from thirty to fifty more sterilization rooms.

#### 4. Gypsy and Browntail Moths, Quarantine Enforcement:

A major revision of the gypsy moth regulated area was effective October 10, 1945: Areas that had previously been designated as generally and lightly infested were merged into one generally infested area. In addition, a suppressive area was created to include former control area in the western sections of Vermont, Massachusetts and Connecticut and adjacent territory in northeastern New York. In these sections infestations had developed to such an extent in the former "barrier" or control zone that restrictions were warranted on host material moving out. At the same time provisions were made for protecting this sparsely infested area from reinfestation so that continued control measures might be applied where feasible. This extension adds approximately 9,100 square miles to the regulated zone, or a 25 percent increase in territory.

Through the inspection service afforded by this project, the forest product industry was enabled to ship under certification during the 1946 year 190,873,076 board feet of lumber, and 85,252 cords of pulpwood. Large quantities of stone and quarry products, including 8,432 tons of granite, and 29,262 individual pieces of granite, were inspected. From inspected products, inspectors removed and destroyed 2,187 egg clusters, 490 larvae, and 183 pupae of the gypsy moth. This was more than a 50 percent increase over infestations intercepted during the previous year.

Quite an extensive survey was made of tourist camps and trailer sites to secure the cooperation of owners of such properties in cleaning up

surrounding gypsy moth infestation. Scattered infestations were found at a few of the sites. Trailer owners were informed of the danger of spreading the gypsy moth on their trailers and camping equipment. Arrangements were made to inspect any such equipment being moved to noninfested points.

Many granite quarries in Vermont and New Hampshire reopened after several years' inactivity. Requests for certification of their products from premises where gypsy moth control work had been neglected increased inspection loads in a number of districts.

Road patrol activities on the border of the generally infested area have been quite effective in compelling truckers to secure inspection of quarantined products that might otherwise move contrary to regulations. A 16-hour per day schedule was maintained during the heavy truck movement of Christmas trees.

Methyl bromide fumigation of Christmas trees succeeds tedious, visual inspection methods previously employed. Prior to this change, because of the hazards involved, inspections were limited to trees from the lightly infested area. Trees from the heavily infested section were prohibited movement. Two Federally-owned portable boxcar fumigation units were in use at Barre and Chester, Vermont. Actual fumigation operations there were performed either by the tree owners or by employees of the State Department of Agriculture. There was an estimated saving to shippers of from \$22 to \$31 per car in handling and hauling costs through fumigation.

Products Inspected and Certified Under Gypsy Moth Quarantine No. 45  
During Fiscal Years 1945 and 1946

<u>Type of Product</u>	<u>Fiscal Year</u> <u>1945</u>	<u>Fiscal Year</u> <u>1946</u>
<u>Nursery-grown stock (Plants)</u>	6,026,786	8,880,110
<u>Forest Products</u>		
Lumber (Board Feet)	190,745,680	190,873,076
Reels	55,060	37,595
Shavings (Bales)	85,112	84,693
Miscellaneous (Carlots)	380	115
" (Tons)	860	227
Barrel Parts, Crates, Etc. (Bundles)	52,711	63,901
Miscellaneous Material (Pcs., Bags, Bales, Boxes, Bundles, Crates, Pkgs.)	168,650	172,938
Logs (Bundles)	2,924	3,499
Logs, Piles, Posts, Poles	1,286,380	884,590
Wood (Cords)	107,563	90,745
<u>Evergreen Products</u>		
Boughs, Twigs, Greens (Bales or Boxes)	31,980	78,008
Christmas Trees	297,838	290,887
Miscellaneous (Bags-Bales-Boxes)	8,757	6,149
Laurel (Bales or Boxes)	8,177	15,365

(Continued on next page)



Products Inspected and Certified under Gypsy Moth Quarantine No. 45  
During Fiscal Years 1945 and 1946 (Cont.)

<u>Type of Product</u>	<u>Fiscal Year 1945</u>	<u>Fiscal Year 1946</u>
<u>Stone and Quarry Products</u>		
Crushed Rock (Tons)	546	9,269
Curbing (Running Feet)	510	1,746
Feldspar (Tons)	32,246	35,484
Granite (Pieces)	10,120	29,262
Granite (Tons)	4,836	8,432
Monumental Stone (Pieces)	6,779	4,561
Grout (Tons)	163	1,021
Marble (Pieces)	2,523	1,956
Paving Blocks	54,000	9,632
Miscellaneous (Pcs., Bags, Boxes, Crates)	761	33,798
" (Cars)	90	55
" (Tons)	2,090	2,332
Total Number of Shipments	155,479	245,536
<u>Infestations Removed from Inspected Products</u>		
Egg Clusters	1,414	2,187
Larvae	46	490
Pupae	93	183

5. Gypsy Moth Control

During the summer of 1945, the trees in woodlands on approximately 800,000 acres were from 25 to 100 percent defoliated by the gypsy moth and during the summer of 1946 there were extensive areas defoliated.

New materials and methods step up control program: Due to the amazing success of the treatment of forest areas infested with the gypsy moth with DDT insecticides by aircraft and with a new type of blower device and to extensive use of a sex attractant for survey work, the plan of work of this project has been greatly changed during the last two seasons. It has been possible to discontinue the use of large crews of men for manual survey work and heavy ground spray equipment, requiring large operationsl crews by taking advantage of recently developed spray equipment and the new insecticide, DDT. Over 5,000,000 acres were surveyed with the sex attractant during the fiscal year 1946. The use of the sex attractant has resulted in greatly reducing the manual survey work and it is now confined to the areas where male gypsy moths are caught by the sex attractant survey. The information obtained by the surveys is used to prepare the control and eradication program. The plan for fiscal year 1946 called for treatment of the most hazardous infestations along the periphery of the area in New York State and in the western part of New England and in Pennsylvania to treat all outlying infestations and 20,000 acres of the most heavily infested area.

Because of the residual effect of DDT the application of control by insecticides was started several weeks before the previously normal time to begin spraying with lead arsenate. Four airplanes and several of the new blowers were used throughout the period when such treatment could be applied. The acreage sprayed during the season greatly exceeded the plans. In New York State, approximately 13,690 and in Pennsylvania 23,738 acres of infested woodlands were treated by airplanes. In the latter State, two entire townships including five boroughs or villages and a large section of the most severely infested area were sprayed. A small amount of aircraft spraying was done in the barrier zone in Connecticut. Approximately 16,150 acres were treated with the new blower type of distributing apparatus and 3,350 acres by knapsack sprayers. Only 22 acres were treated with the conventional heavy-duty ground spray equipment. During the season, a total of approximately 82,000 acres or 128 square miles of infested woodlands were treated.

As a result of demonstrations carried on during the spring and early summer of 1945 and 1946 there has developed a greatly renewed interest and hope in controlling gypsy moth infestations in woodlands, along highways and on shade trees in the older infested area of New England. Several of the States and towns and commercial concerns have purchased the new type of blower and have treated many acres of severe infestations. In a few cases, towns and individuals have hired commercial concerns to treat properties with DDT by airplanes.

Although there has not been an opportunity since the treatment applied during the 1946 season to examine extensive areas, preliminary observations indicate that it has again been very effective. To spray as much area as was covered by aircraft, blowers and knapsack sprayers in 1945 using high-powered ground spray units, it would require 400 machines and approximately 4500 men and would cost considerably over \$1,000,000. Observations made throughout and following the spraying indicate that there was no injury to wildlife, including birds and fish, with the dosages used and no adverse criticism has been received. Indirectly, the fly and mosquito nuisance was greatly abated in the treated areas.

## 6. Dutch Elm Disease Control

Surveys conducted to detect the presence of the disease in new areas:

In some states, authorities are conducting Dutch elm disease control work and Federal crews are continuing surveys to find diseased trees and infected elm material for removal and destruction by local or State agencies, with confirmations found during the fiscal years 1945 and 1946 as follows:

	Confirmations found		Square Miles	
	FY 1945	FY 1946	In 1945	In 1946
Connecticut	141	189	844.2	417.2
Delaware	37	9	32.9	0
Indiana	3	203	44.8	35.8
Maryland	252	42	314.0	137.9
Massachusetts	35	153	334.0	276.2
Vermont	0	2	0	83.7
Virginia	5	4	87.3	127.8

During the last quarter of fiscal year 1946, Federal scouting activities were suspended in the uninfected portion of the States where no organized control programs were operating, (namely New York, Pennsylvania, New Jersey, West Virginia, Kentucky, and Ohio) and the personnel was assigned to exploratory scouting in uninfected States and areas. This work was designed to provide information on new locations where the Dutch elm disease occurs so that action to prevent the introduction, spread, or intensification of the disease could be taken where desired. This work is still in progress. Before 1946 scouting activities were discontinued in the States having no organized control programs, they had disclosed 670 cases of Dutch elm disease and added about 8,700 square miles to the previous known infected area.

Exploratory surveys are being made along railroad routes originally associated with the movement of imported elm logs from ports of entry to veneer mills, at points where elm has been reported as used in manufacturing, and in areas where elms dying from various causes have resulted in the build up of large bark beetle populations. These surveys are being made in Alabama, Arkansas, Georgia, Illinois, Kansas, Louisiana, Maine, Michigan, Mississippi, Missouri, New Hampshire, North and South Carolina, Tennessee, Texas, Wisconsin, Kentucky and Ohio.

Experimental control plots continued: During the fiscal year 1944 three experimental plots were established to test possible means of controlling the Dutch elm disease. Two of these included about 12 square miles, and one 10 square miles. In one of the 12 square mile plots tests were made of the effectiveness of thorough scouting and sanitation throughout the entire area; in the other 12 square mile plot the effectiveness of thorough scouting and sanitation in a center of 3 square miles and bark beetle trapping in surrounding 9 square miles were tested. In the 10 square mile plot, thorough scouting and sanitation was tested against the combined Dutch elm disease and the elm virus disease (Phloem Necrosis). Observations and continued tests during the past season indicate the difficulty of maintaining effective localized control in areas of general infection.

In addition to the larger plots, four small test plots were set up in 1946 for evaluating the effectiveness of the application of DDT insecticides in reducing populations of the native elm bark beetle, and the European elm bark beetle, and of controlling the Dutch elm disease in local areas through control of these bark beetles. Plots of this type will also furnish an opportunity to develop practical and safe formulae and methods for applying DDT insecticides to large elms in urban, recreational, and rural areas.

Diagnosis of disease organism: During the fiscal year 1946, the Dutch elm disease service laboratory cultured 10,322 specimens from elms suspected of having the Dutch elm disease, in order to make a definite determination. More than 50% of these specimens were bark and wood square samples requiring a longer period in culture and more culture plates than twig samples. The fungus causing the Dutch elm disease was isolated from 2,650 of these specimens. Comparable figures for 1945 were 11,658 specimens and 1,366 positive cases. Improvements in culture



techniques contributed materially to the detection of the fungus in 325 new areas in fiscal year 1946 as compared to 297 areas in fiscal year 1945. Tests were made on the most practicable number of plates to make, temperature during incubation period, and the use of dichlorophenoxyacetic acid (2,4-D) as a selective antiseptic.

Enforcement of Dutch elm disease quarantine complicated by presence of phloem necrosis: The finding of Dutch elm disease in Ohio and West Virginia territory already invaded by phloem necrosis, another virulent disease of elms, has further complicated enforcement of the Dutch elm disease quarantine. It has been difficult to devise an enforcement policy that could be considered consistent and effective when applied where both diseases occur. The vectors responsible for spreading phloem necrosis have not yet been determined, nor can it be recognized in its early stages. Consequently, it is problematical whether even an outright embargo on elm material would effectively check the disease. This situation has also hampered revision of the quarantine regulations in other States.

#### 7. Phony Peach and Peach Mosaic Eradication

Phony peach and peach mosaic disease control continues to show encouraging results: Federal-State cooperation in control of phony peach and peach mosaic diseases have continued the objectives of previous years - to prevent spread of these virus diseases in nursery stock, to eliminate them from lightly infected States, and to protect commercial orchards from excessive losses of trees - with the hope of finally reducing incidence to a minimum or eliminating these diseases from large areas.

Nursery inspection covered 357 nurseries containing nearly 13 million trees, with their 1 mile environs, and 35 budwood sources and their environs. Only 3 nurseries failed to qualify for interstate shipment. As a result of these efforts over a period of years there is no evidence that these diseases are being spread through nursery stock.

Orchard inspection for both diseases in 1946 was conducted in 209 counties in 15 states, covering approximately 55,100 properties containing over 10-1/2 million trees. There were found more than 83,000 phony infected peach trees and in excess of 5,900 infected with mosaic. Practically all these trees were removed.

Orchard inspection for phony peach originally covered 17 States, of which 7 have been dropped after showing no phony disease for 3 years. In 7 others the incidence of this disease has constantly decreased during the years of control work. No phony disease was found in Tennessee during 1945. In Georgia and Alabama limited inspection efforts are apparently holding the disease in check.

There has been a continuing, though not pronounced, drop in peach mosaic incidence in recent years, and the area of infection is being reduced from year to year.

### 8. Barberry Eradication

Reduction of 50 percent in annual stem rust losses during past 15 years indicates success of control program and represents yearly saving of about 24,000,000 bushels of grain, more stable production, and better quality grain: Present world food requirements emphasize the importance of achieving more stabilized production of wheat, oats, barley, and rye, by protecting them against such hazards as stem rust. The economic importance of these crops has prompted 18 grain-producing states to vigorously apply stem rust control measures. These states produce annually about 1-1/2 billion bushels of wheat, oats, barley, and rye valued conservatively at approximately \$1,000,000,000. These grain crops are one of the Nation's most important and basic sources of food and feed.

Barberry eradication is a fundamental stem rust control measure, as these rust-spreading plants are the only local source of infection in the cooperating states. Their removal prevents local outbreaks of the disease, and reduces the opportunity for the fungus to develop new and virulent races capable of attacking new and improved varieties of grains.

Rework is urgent problem: Many areas in which barberries were initially suppressed are now being reseeded from bushes that have reached the fruiting stage since the last eradication. Rework of these areas has been constantly falling behind schedule since the outbreak of the war. Areas requiring rework include 199,393 square miles, much of which was worked with WPA labor. The war prevented adequate follow-up on rework and it is now behind schedule on areas aggregating 65,600 square miles. Table 2 which follows in these notes shows the status of barberry eradication through 1945.

Barberry eradication brings dividends in increased grain crops: The effectiveness of barberry eradication in preventing local outbreaks of the disease in control areas is continually being demonstrated in local areas by increased yields and better quality grain following removal of these bushes. In Pennsylvania where the work has been undertaken in recent years, records obtained from 168 farmers showed average oat yields had increased 123 percent during the five-year period following barberry eradication. Similar reports from 68 farm operators in Virginia showed their average yield of wheat had increased 82 percent. As information regarding these benefits becomes known to other farm operators outside the protected areas who are experiencing stem rust losses, they request assistance in clearing their lands of rust-susceptible barberries.

Stem rust damage of wheat during 1945 was confined to restricted areas, although weather conditions were favorable for its development and spread. Apparently this was due to the light infection on barberries and the unusually small amount of the rust overwintering in the South. Stem rust of oats was more prevalent and the crop was damaged approximately 10 percent in Oklahoma, Kansas, and Nebraska. In the northern oat-producing states the losses averaged about 3 percent, but in the country as a whole, the damage was relatively light.

Over-all administration, leadership, technical direction, and coordination are provided, and the quarantine enforced in connection with the operation of the cooperative barberry eradication program. In addition about 35 man-years of labor to carry on cooperative barberry eradication work are furnished. The participating states, Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Montana, Nebraska, North Dakota, Ohio, Pennsylvania, South Dakota, Virginia, Washington, West Virginia, Wisconsin, and Wyoming, provide facilities to help carry on the program by employing field supervisors and labor, regulating the intrastate movement and propagation of barberries, informing grain producers on methods of controlling the disease, enforcing state legal responsibility for the destruction of barberries, and furnishing materials and equipment for the work. Also, numerous counties, private agencies, and individuals furnish assistance to aid the progress of the program. Indicative of the active interest of participating state and local agencies is the increase in cooperative funds provided for this work from \$102,973 in 1941 to \$160,837 in 1946.

Nursery industry very favorable toward work designed to prevent the reintroduction of rust-susceptible barberry bushes into the cooperating control states: Of the 42 nurseries making application to ship Berberis and mahonia plants under the provisions of Federal Quarantine 38, permits were granted to 26 without inspection on the basis of previous inspection records. The remaining 16 firms were either new applicants or recently had been growing susceptible stock and were granted permits on the basis of current inspections. Nurserymen generally are checking their seed source and "liner" stock of B. thunbergii and destroying susceptible varieties to limit their trade only to those species and varieties of barberry that are highly resistant or immune to stem rust.



Table 2.--Status of Barberry Eradication through 1945

State	Square Miles			No. of Properties with Barberries			Barberries
	In	On	Unworked	Cleared	On	Requiring	
	Control	Maintenance	ing Rework	to Date	Maintenance	Rework	to Date
Colorado	74,685	71,070	3,615	2,787	1,274	1,513	17,201,194
Illinois	56,043	34,711	21,332	19,641	8,025	11,616	2,738,791
Indiana	36,045	26,519	9,526	6,896	4,644	2,252	400,256
Iowa	56,167	30,558	25,609	15,224	6,243	8,981	1,284,617
Michigan	57,481	39,611	17,870	17,609	9,605	8,004	6,629,115
Minnesota	80,883	29,259	51,624	8,884	4,399	4,485	1,000,342
Montana	146,316	144,347	1,969	637	320	317	48,457
Nebraska	77,268	63,454	13,814	4,807	4,126	681	146,231
North Dakota	70,183	65,864	4,319	1,074	939	135	39,403
Ohio	40,740	23,476	17,264	17,074	5,856	11,218	3,274,752
South Dakota	76,868	67,527	9,341	1,495	1,182	313	136,002
Wisconsin	54,852	16,099	38,753	17,047	5,170	11,877	5,671,189
Wyoming	94,487	94,383	104	125	55	70	5,531
Sub-total	922,018	706,878	215,140	113,300	51,838	61,462	38,575,880
Missouri	36,016	25,791	10,225	1,394	442	952	20,433
Pennsylvania	27,073	4,261	22,812	8,691	0	8,691	13,832,798
Virginia	11,821	1,418	10,403	3,909	2	3,907	140,047,145
Washington	32,662	500	32,162	636	0	636	32,361
West Virginia	14,296	9,786	4,510	2,032	0	2,032	131,253,929
Sub-total	121,868	41,756	80,112	16,662	444	16,218	285,186,666
Grand Total	1,043,886	748,634	295,252	129,962	52,282	77,680	323,762,546

Table 1.--Results of Barberry Eradication, Calendar Year 1945

State	Area :		Properties :		Bushes Destroyed		
	: Sur- veyed :	(Sq. Mi.)	: New :	Cleared :	: Berberis :	: Narive :	
		(No.)		(No.)	: vulgaris :	: Species* :	Total
					(No.)	(No.)	(No.)
Colorado	189	23	88	90	833,645	833,735	833,735
Illinois	385	53	87	1,544	0	1,544	1,544
Indiana	290	10	35	106	0	106	106
Iowa	489	37	165	2,705	0	2,705	2,705
Michigan	1,283	194	399	4,291	0	4,291	4,291
Minnesota	622	19	60	2,234	0	2,234	2,234
Missouri	173	16	17	94	0	94	94
Montana	706	0	6	10	0	10	10
Nebraska	296	6	5	20	0	20	20
North Dakota	444	0	1	16	0	16	16
Ohio	377	59	110	3,284	0	3,284	3,284
Pennsylvania	13	9	271	13,781	0	13,781	13,781
South Dakota	74	0	0	0	0	0	0
Virginia	76	65	104	0	4,980,561	4,980,561	4,980,561
Washington	774	238	22	10,957	0	10,957	10,957
West Virginia	56	6	73	0	4,211,674	4,211,674	4,211,674
Wisconsin	1,568	50	204	1,859	0	1,859	1,859
Wyoming	0	0	0	0	0	0	0
Total	7,815	785	1,647	40,991	10,025,880	10,066,871	10,066,871

\*Berberis fendleri A Gray and B. canadensis Mill.

## 9. Pink Bollworm and Thurberia Weevil Control

Inspection for pink bollworm: Inspections of the 1945 cotton crop were made in Alabama, Arizona, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, New Mexico, Oklahoma, Texas, and in the principal cotton growing areas of Mexico. As in the past, reliance was placed on gin trash inspection to determine the presence or absence of the pink bollworm in areas not previously known to be infested. However, this was supplemented by inspection of cotton blooms and bolls in the field and laboratory to a greater extent than had been possible for a number of years because of greater availability of trained personnel. Approximately 70,000 bushels of gin trash were inspected during the year.

Pink bollworm found to have spread to additional counties: Outside of the quarantined area new infestations of pink bollworm were discovered in the following Texas Counties: Harris, Liberty, Chambers, Medina, and Brown. These newly infested counties are not important cotton growing counties but the finding of pink bollworms in such outlying areas demonstrated the importance of continuing the intensification of the program to reduce infestation in such focal areas as the Lower Rio Grande Valley of Texas and in the adjacent area of Mexico.

Decrease in infestation found within some regulated areas: Intensive inspections in Cameron Parish, Louisiana which was a non-cotton zone area in 1944 and in adjacent sections of Louisiana, did not show any infestation. Within the regulated area a further decrease in infestation was found in Cameron and Hidalgo Counties in the Lower Rio Grande Valley of Texas, and a general but light infestation in the greater portion of the Coastal Bend area, with an increase being present in Kleberg, Jim Wells, and Duval Counties. El Paso County - an irrigated valley - showed an increase in infestation, as did a localized section in Maricopa County, Arizona. There was no change in Arizona with respect to the Thurberia Weevil infestation.

The areas where infestation was discovered produce comparatively little cotton. To prevent artificial spread it is important, however, to promptly stop movement of untreated products from a known infested area to noninfested areas. Consequently, the newly infested counties were placed under emergency quarantine by proclamation of the Governor of Texas immediately after such discoveries. This action provided that all products be subject to all requirements of Federal and State Quarantine regulations. In the newly infested area on the Gulf Coast of Texas (Trinity Bay area), cottonseed for planting belonging to 171 farmers was treated. Additional seed in the hands of the growers was disposed of through feeding or taken to designated oil mills, where it was treated upon arrival.

Amendment of quarantine: The pink bollworm quarantine was amended to provide for the movement of cotton seed from the Lower Rio Grande Valley after a second heat treatment of seed in addition to that given



as a continuous process of ginning. This permitted seed produced in this area of moderately heavy pink bollworm population to be marketed in other areas. Mill facilities are inadequate to handle the huge production of cottonseed in the Lower Rio Grande Valley.

1945 clean-up program successful: In south Texas and adjacent areas of Mexico the cotton plant will remain alive and continue to fruit throughout the year if left undisturbed. Furthermore, a long growing season results in the production of squares, blooms, and bolls with a consequent increase in the number of generations of pink bollworm. It is, therefore, necessary to limit the period in which cotton can be grown by establishing a uniform period of planting and a date by which time all cotton plants must be destroyed. In 1945 the State of Texas set August 31 as the deadline date for the beginning of cotton free period in the Lower Rio Grande Valley. The farmers were required by State regulation to deposit \$10 per bale in escrow to guarantee compliance with this requirement. Favorable weather conditions were conducive to a good planting, growing, and harvesting season in 1945. The growers were able to meet this requirement and only a little over 100 acres of standing stalks out of an original total of 265,000 acres of cotton were present in the Valley on September 1, 1945. This early creation of a cotton host-free period resulted in perhaps at least one fewer generation of pink bollworms with a greatly reduced number going into hibernation. Consequently, the initial infestation in 1946 was the lowest since about 1938.

Field scale experiments in 1945 with DDT insecticides gave the first evidence that it might be possible to effectively supplement cultural control practices with insecticide control during the growing season: Supplemental funds were provided in 1946 in order that an intensive inspection of early fruiting fields which are known to attract the emerging pink bollworm moths might be carried on in the Lower Rio Grande Valley and the adjacent Matamoros area in Mexico. As soon as the funds became available inspectors were assembled, DDT procured, and contracts made with commercial airplane dusting companies. All known infested fields in both the Lower Rio Grande Valley and the adjacent Matamoros area were dusted from 1 to 3 times during the month of June, 1946. The insecticidal control program has been continued throughout the season. Infestation in these early infested fields treated with DDT remained low.

Cultural control programs, including cotton stalk destruction to create a host-free condition in other counties in the subtropical areas of Texas and Louisiana; cotton field clean-up, involving the cutting, raking and burning of cotton stalks and shattered debris; deep plowing; pasturing fields, using large numbers of animals so as to force them to eat all available material such as locks and shattered bolls, are now being practiced in cooperation with growers on approximately 750,000 acres in areas infested or exposed to pink bollworm infestation.

The State of Arizona prohibited the growing of stub cotton in 1946 in a large area of the Salt River Valley as a means of reducing carry-over of pink bollworms from the 1945 to the 1946 crop. Stub cotton normally fruits earlier than current planted crops.

Cooperation with the Mexican Government benefits cotton growers of the United States: It is considered fully as important to the American cotton industry to bring about a definite reduction, and hold such reduction, in the pink bollworm population in the infested cotton growing areas of Mexico as it is to secure such a reduction in this country. Trained technical employees of the Bureau are working in close cooperation with the appropriate officials of the Mexican Department of Agriculture in not only the border areas but also in the important cotton growing area of the interior of Mexico, known as the Laguna and in the Delicias area of Chihuahua which, while not such a heavy producer of cotton, is an important area from the standpoint of pink bollworm control. The Bureau employees - working through the Mexican officials - aid in carrying out educational work with growers and processors.

This close cooperation between the pink bollworm agencies of the two countries has resulted in a more uniform program of control and regulatory practices in the two countries than would have otherwise been possible. It is believed control of early infestations in areas closely adjacent to cotton fields in the United States will result in less infestation developing in these nearby fields in our country.

Spread of pink bollworm from wild cotton in Florida prevented by keeping infestations low: The effort to eradicate the wild cotton in southern Florida has made it necessary to cover on foot hundreds of square miles of marginal land along the coast, hundreds of islands off the coast of Florida, jungle-like areas far removed from highways in the Florida Everglades and the banks of rivers and creeks in thickly populated farming areas. The recurrence of tropical hurricanes which are capable of moving open locks of cotton long distances makes it imperative to re-scout all of the area adjacent to known locations of wild cotton.

In order to prevent fruiting of wild cotton the areas must be cleaned and recleaned of all plants during the course of the year. Progress has been made in the direction of removing plants before they mature fruit which falls to the ground and often is not recovered due to the heavy growth of weeds and grass beneath the wild cotton plants. The ultimate eradication of the wild cotton is completely dependent upon covering the areas at frequent enough intervals to absolutely remove all plants before fruiting occurs.

Laborers were more abundant toward the close of the 1945-46 season than during either the early part of the season or the previous year. However, there was a decrease in actual acreage covered in 1945-46 over that covered in 1944-45, due to the shorter work season and much heavier undergrowth. A total of 44,830.55 acres was cleaned and recleaned as compared with 53,611-5/8 acres over the previous year. The acreage shown includes a duplication of the areas cleaned more than once. Since the start of the program 16,831,210 wild cotton plants have been removed, of which 236,009 were removed this year; 4,585 plants had mature bolls compared with 8,276 for the previous year. This indicates continued progress in preventing the fruiting of the plants before removal.

10. Transit Inspection

Increased inspection activities necessary at transfer points due to changes in quarantine regulations and lengthened harvest season:

Great increases in air and truck transportation and increases in regulated areas have added many new points of inspection in already operated centers and have increased importance of other centers of distribution. Changes in quarantine regulations have lengthened periods during which temporary stations need to be operated and have increased the importance of permanent stations over longer periods. The lengthening of the harvest season for citrus in the regulated area of Texas made it necessary to assign additional inspectors at Houston, Texas, during the spring months to check on fruit shipments when sterilization of citrus fruit was required under the Mexican fruitfly quarantine. Houston is the principal gateway through which such fruit passes in movement to other parts of the United States. Two inspectors were assigned to Columbus and Crestline, Ohio, during the months of July and August. These are the principal transfer points through which carlots of fruit and vegetables pass, moving westward from the heavily infested Japanese beetle regulated area. Twenty carloads were intercepted moving in violation of the Japanese beetle regulations.

During the fiscal year 1946, 18 stations were operated at strategic transfer points. Nearly 2,000,000 shipments were examined and 1,498 were found to be moving in violation of Federal domestic quarantines. In addition, 507 shipments were found to be moving in apparent violation of state quarantines or nursery inspection regulations and were reported to the states concerned.



### (c) Foreign Plant Quarantine

Objective:: To protect agriculture by administering plant quarantines and regulatory orders, issued under the Insect Pest Act of 1905, the Plant Quarantine Act of 1912, as amended, and the Mexican Border Act of 1942, to prevent the entry of insect pests and plant diseases from foreign countries, Puerto Rico, and Hawaii and control and safeguard the entry of plants, plant products, and other articles which may carry such pests.

The Problem and its Significance: The estimated average annual losses from introduced foreign insect pests of plant and plant products is \$1,500,000,000. This figure does not include huge annual losses from introduced fungus, bacterial, and virus diseases of plants. It is important that every practical effort be made to prevent the introduction and establishment of additional foreign plant pests which could further impede the production of food supplies, essential crops, and the agriculture of the country as a whole.

World commerce has been completely changed by the war and its aftermath, and current conditions impose new problems of foreign plant quarantine enforcement. In addition to the rapid return of commercial shipping, there continues a considerable movement of the ships and aircraft, troops, and supplies of the armed forces.

General Plan: Under the Plant Quarantine Act most kinds of plant propagating materials, fruits, vegetables, cotton lint and related products, cereals, etc., may be imported only under permit subject to inspection, and in some instances supervised disinfection, sterilization, etc., at the ports of entry. In Hawaii and Puerto Rico the movement of certain plants and plant products to the mainland is supervised, and certain products are treated under supervision for the prevention of the movement of injurious pests with these products.

During the fiscal year 1947, cooperation from States and territories will amount to \$293,450, the major contribution being from California and Florida.

#### Examples of Progress and Current Program:

Inspection of air-borne traffic: The inspection of air-borne traffic is of increasing importance because of: (1) increase in air express and freight and (2) the shift in traffic to a preponderance by commercial aircraft from a preponderance by military aircraft. Inspection of 58,631 aircraft from foreign countries in 1946 at 45 ports of entry was an increase of 28 percent over 1945. Airplanes inspected in Hawaii prior to departure for the mainland numbered 9,047, an increase of 9 percent over 1945. Plant quarantine inspection service was discontinued at 4 military airports in 1946, but Westover Field,

an Army airport, is now staffed at the expense of work in New York and Boston. The expansion in civil air traffic is reflected by increased size of aircraft and frequency of arrivals, both by long established air lines and by the many newly organized air services. For example, 22 air lines and services now serve Puerto Rico as compared with about 5 of a year ago.

The fundamental importance of airplane inspection is illustrated by finding potential pest-bearing plant material on 12,156 airplanes from foreign countries during 1946, an increase of .66 percent over 1945.

To further illustrate the problem of air-borne traffic, there is the question of transportation and distribution of living insects not associated with host materials which may enter aircraft while on a foreign field and be carried to the United States. There are those who insist that the several newly established and destructive pests recently found in Hawaii were introduced in this manner. One of these is a destructive fruitfly, previously unknown in this country, which has a long list of hosts that includes both bananas and pineapples - major fruit crops of Hawaii. Arrangements have just been concluded to disinsectize foreign aircraft arrivals in Hawaii for agricultural insect pests, a protection service not heretofore given. The year 1947 will see further expansion in air freight movement. Perishable plant products subject to plant quarantine control at time of entry will be included in this traffic according to all available, reliable indications.

Inspection of Departmental plant material: Exotic plant material from foreign countries imported by the Department of Agriculture for experimental and scientific purposes flows through a special inspection facility for careful examination for pests, and treatment if necessary. Excepting that which represents the minimum of pest risk, it is then grown for a period in detention under quarantine conditions with frequent reinspections for pests before it or progeny is released for distribution. While the total number of these importations is not large, the need for this protection is great as indicated by the 242 pest interceptions during the year 1946. The Department's importations inspected in 1946 were 427, as compared with 357 in 1945. The number of outgoing shipments of Departmental material inspected prior to dispatch was 1,580, as compared to 1,771 in 1945. Among the important pests intercepted at the Washington Inspection House in 1946 were two destructive pests of avocados - the avocado seed moth and the avocado weevil - in seed of that fruit from Guatemala. Living bruchids were intercepted in seeds from Chile and Brazil.

Inspection of Mail: By the close of 1946 the volume of mail from members of the armed forces abroad had dropped off to the extent that it was possible to reassign personnel formerly at two mail inspection

points. However, the danger of plant pests gaining entry by means of this class of mail was increased by the relaxation of censorship which had formerly served to enforce Army and Navy directives against the inclusion of objectionable plant material in service mail. Meanwhile the flow of civilian mail is increasing. Therefore, the responsibility for protecting American agriculture against foreign pests arriving with all classes of foreign mail now rests almost entirely on the plant quarantine service. While only a part of the volume of foreign mail arriving in 1946 could be examined by the personnel available, the number of packages examined was 8,161,717 as compared with 3,045,324 in 1945, an increase of 168 percent.

Mail dispatched from Hawaii and Puerto Rico to the mainland is inspected for compliance with quarantines regulating the movement of certain plants and plant products to the mainland. The examination of such mail in Hawaii covered 678,065 packages as compared with 785,139 in 1945 a decrease of 4 percent due largely to the decrease in servicemen's mail. Similar examination was made of 94,498 packages in Puerto Rico, as compared with 63,655 in 1945, an increase of 48 percent.

Among the interceptions of plant pests taken in mail were such notoriously destructive insects as the pink bollworm of cotton, the West Indian fruitfly, and the Asiatic rice borer. A serious pest of beans, not known to occur in the United States, was taken in dry beans from Guatemala.

Inspection of ships, passenger train, vehicular, and pedestrian traffic: In 1946 there was a marked swing from wartime traffic and commerce to commercial shipping and other surface traffic over our borders. This movement is continuing in 1947.

During 1946, 47,299 ships were inspected as compared with 35,194 in 1945, an increase of 34 percent. More than one in six, or 8,582 ships, were found to be carrying prohibited plant materials, all of which were potential pest carriers and were found to harbor injurious plant pests. The disposal of garbage from ships, which is likely to present risk of spread of plant pests, is also a serious problem.

During 1946 a total of 5,789,244 vehicles entering from Mexico was inspected, an increase of 25 percent over 1945. Pullmans and passenger coaches inspected upon arrival from Mexico totaled 4,289, a decrease of 25 percent from 1945. In cooperation with customs officers, 1,262,304 pieces of baggage were inspected on arrival from Mexico, an increase of 37 percent over 1945. As an illustration of the importance of plant quarantine protection against the pest hazard represented by this flow of traffic, the interception in baggage of some potatoes from the interior of Mexico is mentioned. These tubers were heavily infested with a destructive potato weevil not occurring



in this country. The tubers were also infected with a most serious disease which, if established in this country, might jeopardize our entire potato industry.

Also, pedestrians and local vehicular passengers purchase and offer for inspection and entry millions of small lots of Mexican fruits and vegetables for local consumption on the American side, requiring large outlays of inspector-hours. Thousands of interceptions of insect pests and plant diseases are made from this source annually.

Inspection, treatment, and certification of cargo; inspection and fumigation of freight cars; and related services: The fiscal year 1946 was marked by the rapid change in commerce from that of wartime to that of postwar character. The following comparative figures, in round numbers, compare the volume of this activity with the volume for 1945:

<u>Item</u>	<u>Number Inspected</u>		<u>% Deviation from 1945</u>
	<u>1945</u>	<u>1946</u>	
Cargo Importations .....	29,521	35,757	+ 21
Fruit and vegetable inspections:			
containers .....	11,000,000	11,400,000	+ 4
pounds .....	5,600,000	6,300,000	+ 13
bunches of bananas .....	57,500,000	50,800,000	- 12
Cotton lint, linters, bagging, .....			
cottonseed cake and meal, .....			
and other cotton products:			
bales .....	425,000	1,050,000	+147
containers .....	1,070,000	250,000	- 77
pounds .....	53,700,000	72,300,000	+ 35
Containers of plant and plant products treated or cleaned .....	162,583	638,263	+292

Large quantities of fibers and cereals, nursery stock, seeds, and other plant products enterable under plant quarantine restrictions were also inspected upon arrival and, where required, treatments were applied under supervision.

The number of interceptions of unauthorized plant materials, intercepted primarily in cargo and baggage, showed an increase in 1946 over 1945, and the same was true for the number of plant pests intercepted, also primarily from cargo and baggage. The comparative figures are:

	<u>1945</u>	<u>1946</u>	<u>% Increase</u>
Number of interceptions, unauthorized plant material .....	68,224	97,801	+ 43
Number of interceptions, plant pests .....	50,875	54,428	+ 7

The flow of American-grown plants and plant products to war-ravaged areas and to reopened and new markets for American produce increased the demand in 1946 for inspection and certification for export to meet the sanitary requirements of the countries of destination. In the case of relief and rehabilitation shipments, this is a service vitally needed to safeguard the rehabilitation programs against hindrance from a transplantation of American plant pests. In the case of American produce exported commercially, it assists the American shipper in maintaining his foreign market. The records for 1946, with 1945 for comparison, are:

	<u>1945</u>	<u>1946</u>	<u>% Deviation from 1945</u>
Number of certificates issued .....	2,198	3,823	+ 74
Number of containers certified ....	860,696	1,483,508	+ 72
Number of kinds of commodities certified .....	37	48	+ 30
Number of countries of destination.	61	80	+ 31

There are indications that demand for this service in 1947 will exceed the demand in 1946.

During 1947 it is expected that the trade will be endeavoring to bring increasing quantities of perishable produce from foreign sources, utilizing fast air transport and speedy, new surface vessels with ample capacity for carrying such cargoes under refrigeration. Late in 1946 several cargo arrivals of fruits marked the postwar inaugural of this traffic. The present and anticipated increase for 1947 in work load under this project, along with increases in other activities, particularly at ports not staffed primarily for cargo inspection, will make it extremely difficult for the present staff of 118 employees on cargo inspection to maintain the degree of plant quarantine service required in 1947 for an essential minimum of plant quarantine protection to the country.

Permit service and the inspection of plant material entered under special permit at Hoboken, New Jersey: Foreign nursery stock is arriving in quantities far exceeding expectations for the postwar era. There was an increase of 197 percent in importations of nursery stock other than in mail, in 1946, over the preceding fiscal year. The number of importations by mail increased 342 percent.

Importations of woody ornamentals, which amounted to 477,737 plants as compared with an average of 161,561 plants for the years 1933 to 1937, inclusive, make it clear that the Hoboken staff, augmented in 1946, is insufficient to clear these valuable plants without delay. The 228 percent increase in 1946 over 1945 in the number of pest interceptions made from plant material forcibly illustrates the importance of this work. These included many injurious forms not known to occur in this country. It was necessary to treat 79 percent more importations to eliminate pests, than in 1945.

The large increase in the number of importations of nursery stock has brought about corresponding increases in related activities, including the issuance of permits, correspondence with importers, and with inspection personnel at the ports. For example, the 4,046 permits issued at Hoboken during 1946 were more than twice the number issued the preceding year. This increase occurred despite simplification of permit procedure by which 4,346 importations were entered under a like number of emergency permits issued at the ports.

Receipts: During the fiscal year 1946 receipts of \$38,356 resulted from the fee of \$4.00 a car charged for fumigating railroad cars entering this country from Mexico. This fumigation is required as a safeguard against the introduction of insects attacking cotton. The estimated receipts from this source in 1947 are \$38,400. Receipts from this source are deposited in the general fund of the Treasury.



STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations 1946	Estimated Obligations 1947	Estimated Obligations 1948
<u>Special Research Fund, Department of Agriculture (Bureau of Entomology and Plant Quarantine):</u>			
Special entomological research deal- ing with the subjects "bee products in relation to health" and "inves- tigations of the properties of bee disease organisms and bee products":	\$20,726:	\$23,800:	\$23,800
<u>Allotment: Regular item for White Pine Blister Rust Control, Depart- ment of Agriculture (Bureau of Ento- mology and Plant Quarantine):</u>			
Leadership, coordination, and tech- nical direction of white pine blister rust control .....	577,366:	729,900:	729,900
Blister rust quarantine enforcement	11,495:	13,450:	13,450
Cooperative blister rust control on State and privately owned lands ..	899,998:	2,000,761:	700,000
Total, White pine blister rust control .....	1,488,859:	2,744,111:	1,443,350
<u>Emergency Rubber Project, Department of Agriculture (Bureau of Entomology and Plant Quarantine):</u>			
Entomological research and advice on guayule rubber .....	3,462:	- -:	- -
<u>Emergency Fund for the President, National Defense (Allotment to Agri- culture) (Bureau of Entomology and Plant Quarantine):</u>			
Emergency insect pest prevention ..	3,000:	- -:	- -
<u>Working Funds, Agriculture, Bureau of Entomology and Plant Quarantine, Advances from:</u>			
<u>War Department:</u>			
For the control of the dog fly along the Florida Gulf Coast ...	77,086:	35,000:	- -
For investigations to determine practical methods of control for insects affecting forest products:	7,456:	10,000:	- -
For continuation of development work on military entomological problems .....	62,285:	96,500:	- -
For investigations on insect control problems .....	143,899:	121,101:	- -

(Continued on next page)

Item	Obligations:	Estimated	Estimated
	1946	1947	1948
Working Funds, Agriculture, Bureau of			
Entomology and Plant Quarantine,			
Advances from: Continued			
Office of Scientific Research and			
Development:			
For investigations on methods			
of control for insects affect-			
ing the armed forces .....	\$167,342:	- -:	- -
Commodity Credit Corporation:			
For the conduct of investigations:			
of methods of properly caring			
for grain in storage .....	2,257:	\$579:	- -
National Housing Agency:			
For making tests and continuing			
research on building materials			
and systems intended to facili-			
tate the Veterans' Emergency			
Housing Program .....	- -:	\$5,000:	- -
Total, Working Funds .....	460,325:	268,180:	- -
Miscellaneous Contributed Funds,			
Department of Agriculture (Bureau of			
Entomology and Plant Quarantine):			
Trust fund deposited by cooperators			
for cooperative work on blister			
rust control, barberry eradication,			
pepper weevil and seed crop insects:	105,447:	148,638:	\$202,000
Penalty Mail Costs, Department of			
Agriculture (Allotment to Bureau of			
Entomology and Plant Quarantine):			
For cost of penalty mail pursuant			
to Section 2, Public Law 364, 78th			
Congress .....	9,447:	12,000:	14,600
TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL			
FUNDS .....	2,091,266:	3,196,729	1,683,750

(d) Control of Emergency Outbreaks  
of Insects and Plant Diseases

This appropriation was included for the first time on a regular fiscal year basis in the annual Appropriation Act for the fiscal year 1945 and has since continued on that basis. Prior to the fiscal year 1945, the work was carried on by supplemental or deficiency appropriations. For practical operating purposes, the work done under this appropriation is conducted on a crop season basis, and the following paragraphs will summarize briefly the activities for the past season, including certain information with reference to work under way at the present time. An appropriation of \$2,800,000 was made in the Department of Agriculture Appropriation Act of 1947, available to June 30, 1947; however, should unanticipated emergencies arise, it may be necessary to request a supplemental appropriation to provide for increased operations from the beginning of the 1947 field season until July 1, 1947, since this fund is an emergency one and not susceptible to precise estimating.

A substantial part of the funds provided by these several appropriations in the past has been used to enable the Department to cooperate with States in combating widespread outbreaks of grasshoppers, and to take active large-scale control measures against the chinch bug, the white-fringed beetle, the Mormon cricket, and the pear psylla. Work has been done from year to year against other pests which, although less widespread, are nevertheless serious threats to important agricultural commodities.

Examples of Progress and Current Program:

White-Fringed Beetle Control: Activities directed toward control, suppression, and prevention of spread of the white-fringed beetle were conducted during the fiscal year 1946 in the infested portions of the States of Alabama, Florida, Louisiana, Mississippi, and North Carolina, representing all of the known infested areas at the time. During the year surveys were also conducted in these and other states for the purpose of locating any undiscovered infestations existing elsewhere.

More effective control program resulted through use of DDT and improved equipment. Evidence of the effectiveness of DDT as an insecticide against white-fringed beetles and the increasing availability of this material for control of agricultural pests resulted in supplementing other insecticides with DDT during the summer and fall of 1945 and in replacing other insecticides with DDT during the spring months of 1946. The return of previous employees from military duty during the year, the utilization of recently developed and acquired improved equipment, and the replacement of other insecticides with DDT resulted in a much more effective control program during the fiscal year than during the previous years, and resulted in very appreciable reduction of populations in areas known to be infested and particularly those which represented major hazards of long-distance spread.



In the spring of 1946 infestations were discovered near Eastman, Georgia, and Fort Valley, Georgia. Prior to this no infestations were known to exist in Georgia. Intensive inspections disclosed that two nurseries in Georgia, one at Fort Valley and one at Macon, which deal largely with ornamental stock, were heavily infested. Shipments of nursery stock from these nurseries have been made to twenty-six states and in many localities in Georgia during the past several years. Inspections are being made in all planting sites of these shipments. A considerable number of the shipments made this season have been found infested and infestation has been detected at locations where shipments were made in previous years. Infestations have been discovered at 60 points in 40 counties in Georgia, at points in two counties in Alabama not previously known to be infested, and at Columoia, South Carolina, in which State no previous infestations were known to exist. The infestations in Georgia occur in part of the peach growing belt and the better farming area of the state, including parts of the extensive peanut producing sections. Peanuts are subject to severe injury by white-fringed beetles and because of possible infestation of hay and nuts provide opportunity for long-distance spread of the insect.

A quarantine hearing has been called for the purpose of considering the advisability of extending the Federal quarantine to Georgia and South Carolina. Personnel have been assigned to these States for delimiting surveys and to assist the states in enforcing State quarantines to prevent the spread of the insect. As more information becomes available the work program for the remainder of the current year and for next season will be developed in cooperation with state officials.

Pear Psylla Control: The general area of infestation by the pear psylla in the northwestern States remained unchanged during 1946. Because of a great increase in the efficiency of survey methods which tended to disclose infestations probably not previously reported, the number of properties found infested during the first 10 months of 1946 was 497, as compared with 264 in 1945, and 321 in 1944. No infestation is now known to exist in Yakima County, Washington, the major pear-producing district of the Northwest, with over a million and a quarter trees. An infestation found in 1944 on a non-commercial property in the southeastern part of the country appears to have been eliminated. Several new infestations have been found in the upper Wenatchee Valley and in the East Wenatchee and Orondo-Beebe areas. There has also been a recent increase in the number of known infestations in the Entiat Valley of Chelan County, and Okanogan County in Washington; and in Kootenai County in Idaho. The control program has prevented substantial increases in the number of infestations in other eastern Washington counties, and the insect has apparently been eliminated from Adams, Franklin, and Benton Counties in Washington, and from Boundary County, Idaho.

Further improvement in survey methods has resulted from the adoption of the sticky band trap, first used in the winter of 1944-45. The bands are most effective during the fall, winter, and early spring when large numbers of the psyllas are in hibernation on the trunk of the tree. On warm days, they move around enough to get caught. It is now possible to carry inspection work during most of the year.

During 1946, approximately 387,000 trees were inspected, as compared with 306,000 trees in 1945, and 211,000 trees in 1944. Although sticky boards were used in most of the inspections made, 73,200 lineal feet of sticky bands were exposed in north central Washington and some other areas during the winter of 1945-46. An additional 135,000 band traps were placed on pear trees late in 1946 for inspection in the spring of 1947.

Due to the shortage of nicotine sulfate, the 1946 spray program was restricted to the spraying of all properties found infested in 1944, 1945, and 1946, and all properties in the Entiat Valley in Chelan County of Washington. The growers applied 4,118,006 gallons of spray to 50,426 trees and the Bureau applied 481,219 gallons to 4,930 trees. Insofar as possible, the growers and the Bureau applied four cover sprays to infested properties at 15-day intervals, but in certain danger areas a more intensive program was followed.

Since 1943 cooperative work has been done in British Columbia to protect the gains made against the pear psylla in the States. Surveys in 1945 disclosed the presence of the insect in increasing numbers throughout the commercial pear-growing areas in British Columbia and resulted in the inclusion of so many trees that Bureau participation in that area was discontinued. The funds and manpower thus released were used to strengthen the work in the States.

Hall Scale Control: The program for the eradication of the Hall Scale near Chico, California, has been continued, in cooperation with the California State Department of Agriculture. Increasing dependance is being placed on fumigation with hydrocyanic acid as a means of accomplishing eradication, although spraying with oil has been continued to hold infestations in check prior to fumigation. Two oil sprays were applied during the summer of 1946. With the limited number of tents available, 1522 of the approximately 12,000 trees in the control area were fumigated during the 1945-46 winter season. An intensive inspection of fruit and bark samples from the trees in a portion of one fumigated orchard has thus far revealed but a single live scale, on a tree adjacent to a group of infested unfumigated almond trees. With the additional tents, equipment, and personnel now available, it is hoped that most of the trees in the control area can be fumigated during the 1946-47 winter season. This work was started in October 1946. Experiments have shown that the fumigation period cannot be safely extended beyond the dormant season. The almond, the tree most commonly infested by this scale, was affected less than peach or apricot during the growing season.

Intensive survey work has been continued during 1946 in the area in and around Chico and extended to certain other areas known to have received host plants from the Plant Introduction Garden. The infested area at Chico has remained practically unchanged and results of inspections in other communities in California and Oregon were negative, with one exception. In July, 83 trees on 22 properties in 7 city blocks were found infested at Oroville, California, about 20 miles from Chico. All susceptible plants in the infested and nearby blocks in Oroville were sprayed with oil in July and again in August, and they will be fumigated or otherwise treated as soon as possible. Since the survey of properties in California known to have received host plants from the Plant Introduction Garden is nearing completion, arrangements are being made to extend the survey to other States.

Grasshopper and Mormon Cricket Control: Grasshopper control was conducted in cooperation with 23 Central, Midwestern and Western states. According to estimates of County and State leaders, control operations in the 1945 field season afforded protection to 5,980,000 acres of crops, and the value of crops saved by these control measures amounted to more than \$29,500,000. Over 25,000 farmers participated in the program, spreading 12,590 tons (dry weight) of bait furnished by the Federal Government. The Department financed the spreading of an additional 530 tons of bait on roadsides, irrigation canal banks, rights-of-way, and idle land; other Federal agencies spread 390 tons of bait on lands under their jurisdiction. An estimated 2,235,000 acres of land were baited in the combined operations. In the spring of 1946, control operations began early and accelerated rapidly to the close of the fiscal year. By June 30, a total of 4,225 tons (dry weight) of bait had been mixed and issued to farmers for grasshopper control.

Control of Mormon crickets was conducted in cooperation with five Western states. During 1945, control operations, which were concluded early in the fiscal year ending June 30, 1946, included the Federally financed spreading of 1,540 tons (dry weight) of bait over about 158,000 acres of range lands. Three-fifths of this area was baited by airplanes, two-fifths by ground equipment, and some acreage (less than one percent) inaccessible to mechanical spreading equipment, was baited by hand. In the spring of 1946, larger numbers of crickets developed than expected in several areas of four states, which called for an increase in the amount of control work planned. At the close of June, 1,120 tons (dry weight) of bait already had been spread on 151,000 acres of land by airplanes, by power spreaders, and by hand. Airplane baiting accounted for 19 percent of the total acreage baited to June 30. Control operations in all areas afforded valuable protection to range and adjacent croplands.

Chinch Bug Control: Chinch bug control was conducted during the 1945 season in cooperation with eight Eastern, Central, and Midwestern states. According to estimates of County and State leaders, 2,500



farmers participated in the program, using 47,000 gallons of creosote oil and 222,000 pounds of dinitro-o-cresol dust furnished by the Federal Government. With these materials the farmers constructed and maintained approximately 380,000 rods of barrier. County leaders estimated that 75,000 acres of crops, valued at approximately \$1,200,000, were protected by these measures. At the close of June, 1946, chinch bugs were reported in economic numbers only in a few isolated localities and there was no general outbreak in 1946.

Mole Cricket Control: The Bureau has cooperated with the Florida State Department of Agriculture and the Extension Service through a Mole Cricket Control Committee in control of epidemic outbreaks of mole crickets in various counties of the vegetable, strawberry, and general farming areas of the State. This work was conducted each year from 1940 through 1945. Bureau participation consisted of procuring bait materials and delivering them to central points in the State and mixing the bait. State agencies through the Mole Cricket Control Committee assumed responsibility for distribution of bait. The work resulted in adequate protection of various crops against severe damage by the mole cricket.

Due to the unavailability of wheat, bran, or crushed wheat in 1946, which is the bait carrier for the insecticide, bureau participation in this program for the current year has been discontinued. Recent experimental work has developed a new formula for control of the several species of mole crickets, which may enable farmers to take care of their own needs for control of this pest.

Golden Nematode Control: The Bureau has participated with cooperating states during the past three years in surveys to ascertain if golden nematode, a destructive introduced pest of white potatoes, occurred in the major potato producing areas of the northern states. A local infestation of this pest was discovered on Long Island, New York, in 1941, where it apparently had been established through introduction from Europe. No infestations have been found elsewhere in the United States. However, the Long Island infestation has been found to occur in approximately 2,700 acres of farm land devoted to production of potatoes in the vicinity of Hicksville, Long Island, of which 1,600 infested acres were found in the 1946 survey. Because of the severity of this infestation and because the golden nematode is considered the most destructive pest of potatoes in infested countries of Europe, the Bureau is cooperating with the State of New York in the enforcement of the State quarantine for the purpose of preventing the spread and introduction of this pest into other potato producing areas of the United States, and in suppressive measures.

In an attempt to lessen the hazard of spread of this pest and to reduce its incidence, the State of New York arranged to remove from cultivation during the calendar year 1946 all farms known to be infested. State

appropriations were secured for the purpose of reimbursing the affected farmers for the loss of the use of their land and for administering the program. As a part of this suppressive program the Bureau is cooperating by procuring and applying a soil fumigant to this infested land taken out of cultivation. Treatment of 1,322 acres of infested land was completed in 1946. The Bureau also undertook to cooperate with the State in conducting extensive and intensive surveys in Long Island to ascertain as quickly as possible the extent of infestations in order that quarantine measures could be extended to any undiscovered infested land to prevent widespread movement of potatoes or other crops which would distribute the pest to points elsewhere in the United States. This survey was carried out during the summer and fall of 1946. The survey will continue during the winter and spring as weather permits. Because of the newly found infested farms, the operationally exposed farms not yet adequately inspected and the many hazards of possible and probable spread to other areas and states, the present quarantine action needs to be materially strengthened.

General Surveys: For several years funds provided under this appropriation have been used to carry on surveys to secure information on the abundance and the threat to crop production of certain important crop pests, including insects attacking cotton, the Mexican bean beetle, pea aphid, cabbage worms, and other pests of truck crops, the screwworm and other insects requiring the use of insecticides. The information thus secured which has been placed at the disposal of cooperating agencies and manufacturers and distributors of insecticides, has facilitated the most effective use of insecticides, many of which are still limited despite the end of the war. It has also enabled the farmers to plan in advance their operations against insect pests. These operations were continued during the 1946 crop season.

Surveys also have been conducted to secure information on pests of limited distribution and those subject to state quarantines. During the current year two special surveys are being made in cooperation with states. One of these relates to the golden nematode, mentioned above, which is now under quarantine in New York State and which would be capable of doing widespread damage in many parts of the country should it become widely distributed. The other deals with the potato rot nematode, an important pest, probably introduced, reported from limited parts of Idaho and British Columbia. Seed potatoes from the latter area have been shipped to various locations in the United States.

Surveys of this type are made as need becomes evident. It is planned during the fiscal year 1948 to conduct surveys in Texas and Louisiana to make sure that no incipient centers of infection are present in the areas in which citrus canker eradication work was done most recently.





BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY

(a) Agricultural Chemical Investigations

Objective: To help farmers and fruit growers find industrial outlets for their products, byproducts and waste; to increase farm income by solving problems which cause loss of value of crops or interfere with their consumption along established lines; to aid in developing new methods for processing certain agricultural crops to more satisfactorily meet consumer requirements; to devise means of improving the initial and storage quality of processed agricultural commodities; to reduce handling and processing costs; to devise methods of processing agricultural materials for feeds; to render technical assistance to farmers' cooperative processing organizations, and to assist in developing "deficiency" crops (e. g. tung nuts) for supplying products of which existing supplies are inadequate.

The Problem and its Significance: There are numerous problems in connection with processing and utilizing the products of tung nuts, sugar plants, and citrus and other fruits and preserving cucumbers and other vegetables, the solution of which would aid both agriculture and the processing industries. Fundamental chemical and biological research is urgently needed on the nature and control of enzymic action, on the toxic effects of substances that may contaminate or exist in food and feeds, on substances that exhibit special biological activity in or towards plants, and on the survival of pathogenic microorganisms in processed foods to serve as a basis for practical research for overcoming certain difficulties in the production and utilization of agricultural commodities.

To accomplish the objectives, investigations will be required on chemical, enzyme, microbiological and pharmacological problems which are basic to practically all crops, and the solution of which will open the way to applications of great importance to agriculture. For example, color and flavor of processed food products, which vary with conditions of processing, are important factors in determining the commercial value of the commodities.

General Plan: In general, basic laboratory research is conducted under this appropriation, and applications are made at twelve field stations located in areas where production of the crops involved is greatest. Cooperation is maintained with other Bureaus of the Department, with State Agricultural Experiment Stations, and with industrial firms and associations.

Examples of Progress and Current Program: The following statements of current programs and examples of recent accomplishments under this appropriation are cited by financial projects:

Fruits, Vegetables and Other Agricultural Products of the South:

Citrus Juices and Concentrates: Studies are under way on the chemical composition and reactions of specific fruit constituents in order to

establish their role in the development of off-flavor and color which results in the deterioration of canned juices. Practical storage tests have been carried out on samples of orange juice stripped of oil and pigment fractions. Even this residual juice undergoes changes in storage at ordinary temperatures, although to a less extent than whole juice. Storage experiments on concentrated orange juice showed that deterioration of flavor and color increases with concentration and high temperatures.

The Eastern Regional Laboratory's process for flash distillation of flavor essences has been further developed to permit flash distillation of citrus juices under vacuum, and conditions have been adjusted to use the process as a means of simultaneous deoiling and pasteurizing of the juices. Processing conditions were modified for concentrating the stripped juice from this process without developing objectionable flavor, so that a high quality concentrate can be produced by reincorporating the natural flavor essence and oil. Frozen concentrate produced by the patented process developed in cooperation with the Florida Citrus Commission is being produced and marketed by an increasing number of canners in Florida.

Feed Yeast from Citrus Wastes: Large-scale pilot-plant experiments have been conducted on the production of feed yeast from the waste liquor resulting from the pressing of citrus pulp for cattle feed. On the basis of a pilot plant constructed at the Southern Regional Research Laboratory for the production of feed yeast from sweetpotato starch "fruit waters," a pilot plant has been installed at a Florida citrus cannery where large volumes of citrus press liquor are available. Continuous operation of the plant has demonstrated the feasibility of economically producing high yields of yeast which, incorporated in a carbohydrate feed, would double its protein content and essential vitamins. The major technical difficulties encountered on this scale of operation have been overcome, and it has been established that the culture can be maintained and yeast grown continuously for indefinite periods under proper control.

Other bacteriological investigations on citrus juices included microbiological surveys of several canneries in which cultures of organisms were collected at each step of the process from delivery of fruit until the juice reached the pasteurizers. From cultures the bacteria were isolated and identified. Identification of yeasts and other organisms is in progress.

Pickles: In cooperation with the North Carolina State College, experiments have been carried out on the processing of nine varieties of cucumbers. Tests were made of the keeping qualities of fresh cucumbers; of the quality of the salt stock obtained from each variety by standard brine fermentation; and of the finished pickles after packing and storage. In these experiments an effort is being made to select cucumber varieties suitable for commercial processing which will be better adapted to southern growing conditions than established varieties developed for use



by the northern pickling plants.

#### Sugar and Sirups Investigations:

Sugarcane Wax: The Bureau has developed a method for recovering and purifying a hard wax that occurs on sugarcane stalks and accumulates in refineries during the grinding of the cane and processing of the juice. Tests by large industrial concerns have shown that this product, ordinarily wasted, can compete with imported flour waxes. Plans are under way to produce the wax on a pilot-plant scale in Louisiana during the 1946-47 season.

Aconitic Acid: Aconitic acid, ordinarily considered a nuisance in sugar refining operations, is exceptionally valuable in the production of modifiers for synthetic resins in making plastics and lacquers. About 6 million pounds of it are potentially available each year in Louisiana alone. A method has been developed whereby the acid also can be readily converted into itaconic acid, which adds materially to the strength and toughness of the clear, colorless plastics used for such purposes as the enclosures for airplane pilots, gunners, bombardiers, etc. On the basis of the Bureau's studies of aconitic acid, a large Louisiana sugar refinery will start its commercial production during the 1946-47 season.

Sugar Beet Storage: Cooperative studies have resulted in the development of more effective methods of outdoor storage of sugar beets to minimize losses in sugar content. Promising results have been obtained in the storage of beets in open-top bins with provision for drawing cold night air through the entire mass, the top layer being whitewashed. Seventy-five tons of beets thus stored for 77 days had lost only 40 per cent as much sugar as control samples from the factory storage pile.

Confectionery: Cooperative studies have been made with the National Confectioners' Association in improving the nutritive balance of confections through a wider use of agricultural products. During the past year an improved method was worked out for incorporating refined peanut and soybean proteins into candies, approaching the 7 to 8 per cent protein level which is considered desirable in finished candies from a nutritional standpoint. Improved jelly candies were made by using a new modified pectin produced in the Bureau's Western Regional Laboratory. The research on confections will be carried forward to a pilot-plant or semi-commercial stage.

#### Investigations on the Pharmacology of Agricultural Products:

Studies have been completed on the chemical and bioassay methods of evaluating the vitamin A potency of fresh and dehydrated vegetables. Investigations of the toxicity and physiological actions of the



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antibiotic, citrinin, also have been completed. Toxicity studies have been made on Norelac (the food package coating material developed from agricultural materials at the Northern Regional Laboratory), on acid potassium saccharate, and on the byproduct feed material resulting from newly-developed continuous processes for saccharifying agricultural residues. Studies on starch sponges are in progress. The comparative acute toxicities of l-nicotine and myosmine, and the biological availability of ascorbyl palmitate, have been determined; and extensive studies are in progress on the pharmacological properties of rutin, the drug recently prepared from buckwheat at the Eastern Regional Laboratory, which shows considerable promise of being useful in treatment of circulatory disorders.

#### Investigations on Enzymes and Phytochemistry:

The chemical mechanism that causes many natural oils to become rancid remains unexplained though it has been worked on for years in many laboratories. The Bureau is conducting experiments on the enzymes which produce rancid effects in oil, but have never been identified in the agricultural products that go rancid quickest. To find and study such enzymes would be a most important step toward stopping their deleterious action.

Work on starch has been continued with the discovery of how to prepare a pure crystalline beta amylase from sweetpotato juice. This material has outstanding value as a scientific tool for starch, fermentation, and protein chemists. An immediate practical application resides in the fact that amylase, an enzyme of considerable commercial value, can be prepared from sweetpotatoes without sacrifice of the starch.

The bitter principle that develops in naval orange juice and prevents its use in canning has been isolated and is being investigated at the request of industrial concerns.

#### Fruits, Vegetables, and Other Agricultural Products of the West:

Processing of Citrus Fruit: Since much of the canned western grapefruit juice in certain seasons is too bitter or too tart for many consumers, experiments have been carried on to correct these undesirable characteristics, and specifications for an ideal juice have been prepared. Sodium carbonates have been found to be inexpensive and effective agents for neutralizing excess acidity. Sugar is added when necessary to maintain a standard sugar-acid ratio. The industry has shown a lively interest in these standardization studies.

Work has been under way on the isolation and identification of the fats, oils, waxes, pigments, and flavoring constituents of California-Arizona grapefruit to determine what chemical changes are responsible for off-flavors and odors in the processed products.

For use in determining optimum conditions for citrus juice deaeration, a process essential for the prevention of deterioration, a simple, inexpensive polarographic apparatus was developed which gives quick and accurate results. Several citrus plants in California and one in Florida have sent their chemists to study this apparatus.

Although many new plants are being built in Southern California for the production of frozen orange juice, the quality of the products now being put on the market is not of the best, because little or no research has been done on this method of preservation. A broad program has been set up to determine the effects of a rapid method of freezing, using a rapid heat exchanger and sealing the deaerated and frozen juice in hermetically sealed cans.

Research has commenced on optimum methods of preparing and packaging frozen grapefruit hearts. A series of samples has been prepared using different sugar sirups and sweetened grapefruit sirups of different concentrations, dry sugar in several proportions, and grapefruit juice as a covering liquid for the segments after packaging. Ascorbic acid was used as an antioxidant in preparing some of the samples.

As a result of past work by the Bureau, a sizeable industry has been built up in Southern California to produce frozen fruit purees, which are used by manufacturers of ice cream, jam, jellies, and canned fruit juices. Tangerine puree has been successfully frozen for use in the preparation of fruit ices, and now the trade wants orange puree for similar uses. Experiments have been set up to determine whether an orange puree can be frozen without developing the characteristic "terpeny" flavor liable to be formed because of the large amount of oil going into this type of product as a result of grinding the whole orange.

Further Developments in Nightshade Berry Flotation: The froth flotation process for freeing peas of nightshade berries and other weed seeds, as developed by the Pullman Laboratory of the Bureau, has been placed in large-scale commercial use during the current canning season. Four canneries have installations capable of cleaning from two to four tons of vined peas per hour. Packers are using this process even in cleaning vined peas not contaminated with nightshade, because of the considerable saving in hand labor and the improvement in quality of the product through removal of splits and skins not removed by hand sorting.

Cooperative studies on the processing of sweet corn and tomatoes grown in certain sections of Idaho have been undertaken. The expansion of the canning industry is desirable in order to establish a greater diversified agricultural program, as well as to provide a longer season for canning plants and migratory labor.

Grape Juice: Studies designed to modify the Concord grape juice produced in the Pacific Northwest to meet present standards have yielded a process



whereby the cream of tartar can be reduced and the acidity increased. Pilot-plant studies on the process are anticipated.

#### Fundamental Investigations in Microbiology of Agricultural Products:

Many samples of 4 to 6 per cent moisture spray-dried egg powder which had been manufactured in compliance with Department of Agriculture and War Food Administration purchase specifications were found to contain microorganisms of the Salmonella group. Cooperative work has established that these organisms were readily destroyed in liquid whole egg exposed to pasteurization temperatures. The pasteurization of liquid whole egg prior to its dehydration has not been universally required. Although at this time egg powder has not been associated with outbreaks of food poisoning in the United States, the production of even an occasional Salmonella-contaminated batch is undesirable. In 1946, the Bureau's studies were extended with the object of acquiring information essential to the elimination of Salmonella organisms from egg products or of determining adequate safeguards. Investigations have shown that Salmonella organisms remain alive for long periods in stored powders. They survive in reconstituted contaminated powder held at household refrigerator temperatures. They multiply rapidly in batches of contaminated reconstituted powder held at 25°, 37° and 45° C. but apparently die out at 55° C. Scrambling as a method of cooking cannot always be depended upon to destroy all the Salmonella organisms which may be present in the reconstituted powder.

The Bureau's research data are being made available to interested Government agencies and are being prepared for publication. They are finding application in the egg processing industries in the selection of raw material, in processing, in laboratory control programs, in breaking rooms and dehydration plants, in improving plant sanitation, in marketing, and in consumer utilization and handling of egg products. These data should also be useful in the establishment of microbiological standards.

#### Tung Nut Investigations:

Drying of Tung Fruit: A major part of the work on tung during the past year has been devoted to the problem of drying dehulled tung fruit. This problem was brought about by the introduction of field hullers and the necessity of storing and processing large tonnages of dehulled nuts at the mills. The most significant results were obtained by controlled drying tests on 600 pound samples of dehulled nuts in a pilot-plant dryer and subsequent commercial-scale expeller tests on recovery of oil from these samples. It was established that this material should not be dried at temperatures in excess of about 175° F. if it is to be stored after drying, as oil could not be efficiently expelled from samples dried at higher temperatures and stored as long as a month.



Miscellaneous Studies and Byproduct Uses: Further progress was made in studies on the undesirable solidification of tung oil extracted with certain grades of solvents. In efforts to standardize methods of analysis for use in the industry, studies were made of the sampling of the nuts and referee analyses were carried out in seven laboratories with satisfactory checks. Experiments were made on various tung oil formulations for waterproofing paper and a formula and method of application developed which stood up for more than three months in a test of waterproofness. Samples of tung press cake from several mills were analyzed with regard to value as fertilizer, the press cake meal being unsatisfactory thus far as a feedstuff since no method of detoxification has been devised. Means of drying tung oil were tried, but it was established that the turbidity developed on cooling filtered oil is due to precipitation of phosphatides rather than moisture in the oil.

Basic Investigations in the Chemistry of Agricultural Products:

Intensive experimentation has been continued with two major objectives: (1) to investigate economically important plants for the presence of chemical substances (antibiotic agents) that may be responsible for the resistance that certain varieties of these plants offer to disease-causing microorganisms; (2) to synthesize chemical compounds (plant hormones) that are capable of modifying the growth process in plants, and to determine the mode of entry and transport and the mechanism of action and fate of these compounds in the plant.

(1) A substance called "tomatin," which inhibits the growth of the fungus causing wilt disease in tomatoes, has been found to be present in the tomato plant. Experiments indicate that tomatin plays an important role in the defense mechanism of the tomato toward this fungus. Antibiotic agent possessing tomatin-like activity have also been found in several other economically important plants and it is believed that these substances may be responsible, at least in part, for the disease resistance of these plants. This work partially substantiates an entirely new concept regarding the mechanism of disease resistance in plants.

Tomatin has also been found to exert strong inhibiting action toward the growth of many of the fungi that cause disease in man and animals. This is highly significant since the medical profession has no drug which is satisfactory in controlling fungus infections even though they are among the most prevalent and serious of human diseases.

(2) The application of plant hormones to produce modifications in the rate and type of growth of plants is now widely practiced experimentally. The cost of such treatment is small enough to permit farm-scale application with resulting increases in both the quantity and quality of agricultural crops. However, in some cases hormones produce, simultaneously, undesirable as well as desirable effects on the plant. If plant hormones are to be used efficiently, the hormones that produce the maximum of desirable effects must be found. To accomplish this, the mechanism

of action in the plant of a given plant hormone must be thoroughly investigated so that a fundamental basis for evaluating hormonal activity can be established.

Tests of more than 50 new organic compounds prepared in the Bureau have been promising. The experience gained in these investigations has made it possible to take immediate advantage of the radioactive chemical elements resulting from atomic bomb investigations carried out during the War. Radioactive iodine is now being obtained so that compounds containing this element can be applied to plants and their fate in the plant traced by means of sensitive radioactivity-detecting instruments.

(b) Naval Stores Investigations

Objective: (1) To develop improved methods and equipment for the production of turpentine and rosin in order to make available products more nearly meeting the physical and chemical requirements of the consuming industries; (2) to determine the chemical composition of pine oleoresin (pine tree gum) and the various turpentines and rosins in order to produce derivatives having industrial value; and (3) to develop methods of handling, packaging, and storing naval stores which will minimize deterioration.

The Problem and its Significance: There is need for more efficient methods of processing pine oleoresin and for developing new derivatives in order to furnish a wider market for naval stores products. Unfavorable changes in the price of turpentine and rosin and the increase in competition of naval stores with other products that were not readily available during the war have made it necessary to expand the program for increasing efficiency in turpentine and rosin production.

Pine oleoresin is the source of raw materials for synthetic rubber, protective coatings, drying oil promoters, soap, and various chemicals such as camphor, cymene, and styrene derivatives. It is an annually reproducible crop having potentialities for increased production.

Turpentine derivatives have been obtained which can serve in actual rubber synthesis, both individually and in compounding products to impart to synthetic rubber specifically desired properties. There is a continuing need for "intermediates" for making synthetic rubber and various chemicals and derivatives useful in the compounding of such rubbers.

Plan of Work: The research and technical work conducted under this appropriation comprise studies on: processes and equipment for naval stores production, chemical structures and properties of components and derivatives of pine gum, turpentines and rosins; and on uses, handling and transportation of naval stores products. Results obtained from studies on components and derivatives constitute a basis for studies on new uses and applications. Whenever possible, results obtained from studies on derivatives and possible uses are translated into larger than laboratory scale work at the Naval Stores Station. Future plans contemplate the expansion of laboratory work on the separation of new and industrially useful products from alpha-pinene, the principal constituent of turpentine and on preparation, composition, and properties of heat-treated rosin and rosin derivatives, and pilot-plant studies on the purification of dehydrogenated rosin. The appropriation for "Naval Stores Investigations" is devoted to work that contributes to the development of a sound postwar economy in the naval stores industry.



Progress and Current Program: The following statement of current programs and examples of recent accomplishments under this appropriation are cited by work projects:

Investigations of Naval Stores Production, Processes and Equipment: Advice and assistance on engineering and operating problems have been given to many naval stores producers, especially to those who have installed new plants for cleaning and processing oleoresin according to the Government patented process. The production, under license from the Secretary of Agriculture for the use of this patented process, was approximately 100,000,000 pounds of rosin and nearly 4,000,000 gallons of turpentine or approximately one-third of the production of gum naval stores. Several new central refineries are being built this year to operate under this Government patent.

Further research in cooperation with the Forest Service on gum from chemically stimulated trees has confirmed that rosin and turpentine of good quality can be made from such gum when it is processed according to the recommendations of the Bureau. Considerable progress has been made in developing a still for the continuous distillation of pine gum. The data obtained from the operation of a six-inch distillation column have been used for the design and fabrication of a larger semi-commercial unit which will be put into operation this year.

Further work is in progress on materials and coatings for turpentine cups; on cooperative studies with the Forest Service on the effects of chemical stimulation on the equipment used in the industry, on techniques of gum cleaning and distillation, and on the quality of the final products obtained; and on dissemination of technical information to gum farmers, producers, and processors through the Bureau's technical staff and through cooperative agents.

Investigation of the Composition, Properties, Components, and Derivatives of Naval Stores: The preparation of synthetic rubber-like materials from isoprene (a turpentine derivative) has been studied intensively. Isoprene has been combined with styrene under a variety of conditions to produce these rubber-like materials of high quality. The synthesis of derivatives from certain organic compounds containing chlorine, such as carbon tetrachloride, and terpenes, such as beta-pinene, has been established. The resulting compounds appear to have germicidal and insecticidal properties. Further work is in progress on these chlorinated terpene compounds as well as a study of the preparation and properties of other terpene derivatives derived from turpentine.

Investigation of the Uses, Handling, and Transportation of Naval Stores: A new emulsifying agent was developed for use in the preparation of synthetic rubbers of the GR-S type. This product can easily be prepared from either pine oleoresin or from esterified rosin. The synthetic

rubber produced has a higher tensile strength than the published figures for commercial GR-S rubber. A method was developed for purifying dehydrogenated rosin for use in the emulsion polymerization of GR-S rubber. Results of tests by the Rubber Reserve Company at the University of Illinois showed a distinct increase in the yield of polymers with dehydrogenated rosin which had been purified by the Division's process. Rosins which had been freed of levopimaric acid were found to yield ester gums and limed rosins with unusually high melting points.

Data were collected, tabulated and published on the production, distribution, consumption and stocks of naval stores by quarters, and at the request of the War Production Board these data were made available to them prior to publication. Monthly surveys of naval stores stocks and monthly reports on the production of steam distilled wood naval stores were also issued during the year. (Note -- The 1948 estimates contemplate the transfer of this statistical work to the Bureau of Agricultural Economics).

Progress is being made on the preparation of various rosin acid derivatives, especially those suitable for use in the emulsion polymerization process for synthetic rubber, as well as derivatives of rosin freed from levopimaric acid; and on the compilation of statistical data pertaining to naval stores on a monthly and a quarterly basis.

(c) Regional Research Laboratories

Objective: To develop by research, new scientific, chemical, and technical uses and new and extended markets and outlets for farm commodities (and their products and byproducts) especially for those commodities of which there are frequent surpluses, including food products, such as: cotton, sweetpotatoes, and peanuts in the southern region of the United States; alfalfa, fruits, potatoes and vegetables, wheat protein, and poultry products and byproducts in the western region; tobacco, apples, potatoes, vegetable wastes, tanning materials, milk products, animal fats, hides and leather in the eastern region; and corn, wheat, and other grains, soybeans, and other oilseed crops and agricultural residues in the northern region.

Efforts are concentrated on the development and improvement of processes that will make possible the profitable production of industrial products for which there is a present or potential demand, and on stimulating industries by showing the possibilities of financial profit from the processing of agricultural materials.

The Problem and its Significance: A basic problem and need of agriculture under normal conditions has been to develop new and extended uses and expended outlets for its products and byproducts.

Many low-grade and waste farm materials, as well as food crops, contain appreciable quantities of valuable constituents that can serve for the production of plastics, synthetic rubber, motor fuels and lubricants, building materials, cloth filler and substitutes, fibers, protein meals, films, adhesives, medicines, pharmaceuticals, solvents, hormones, and other vital constituents.

Ample supplies of most farm commodities, together with surpluses of agricultural residues, constitute a reservoir from which to draw raw materials for such products and processes as are developed.

General Plan: The research work under this appropriation covers the principal agricultural commodities produced in the 46 States. Through chemical, physical, and biological laboratory investigations, it is planned to develop new products and processes involving these commodities, and through chemical engineering research on pilot-plant scale, to establish the commercial feasibility of particular products or processes leading to the commercial development and use of farm products.

Emphasis during the war period was placed on the development and improvement of products from farm commodities, and of processes which had immediate significance and application to the war needs. Short-term problems, the solution of which would contribute to the war program, were emphasized. Long-term basic studies, as originally planned for these laboratories, are now being resumed to meet postwar and peacetime needs.



Indicated below are the areas to be served, together with the commodities to be given primary attention, by each of the Laboratories:

Southern Regional Research Laboratory, New Orleans, Louisiana

<u>Area</u>	<u>Commodity</u>
Alabama	Cotton
Arkansas	Sweet potatoes
Florida	Peanuts
Georgia	
Louisiana	
Mississippi	
Oklahoma	
South Carolina	
Texas	

Eastern Regional Research Laboratory, Wyndmoor, Pennsylvania

<u>Area</u>	<u>Commodity</u>
Connecticut	Apples and other fruits
Delaware	
Kentucky	Vegetable wastes
Maine	Tobacco
Maryland	Milk Products
Massachusetts	Potatoes
New Hampshire	Animal fats and oils
New Jersey	
New York	Tanning materials, hides, skins, and leather
North Carolina	
Pennsylvania	
Rhode Island	
Tennessee	
Vermont	
Virginia	
West Virginia	

Western Regional Research Laboratory, Albany, California

<u>Area</u>	<u>Commodity</u>
Arizona	Alfalfa
California	Fruits, including apples
Colorado	
Idaho	Vegetables, including potatoes
Montana	
Nevada	Poultry
New Mexico	Wheat
Oregon	
Utah	
Washington	
Wyoming	

Northern Regional Research Laboratory, Peoria, Illinois

<u>Area</u>	<u>Commodity</u>
Illinois	Agricultural residues
Indiana	Corn, wheat and other cereal crops
Iowa	
Kansas	Soybeans, and other oilseed crops
Michigan	
Minnesota	
Missouri	
Nebraska	
North Dakota	
Ohio	
South Dakota	
Wisconsin	

It will be noted that research on certain of the commodities has been divided between two laboratories. Such division of effort is based on the importance of the commodity under investigation in the two regional areas to which assigned. Careful consideration has been given to the composition of these commodities, which suggested different types of utilization, and to the coordination of the research activities of the laboratories concerned.

The research program for each laboratory, by commodities is briefly discussed in the following statements:

Southern Regional Research Laboratory

PROJECT STATEMENT

Project	1946	1947 :(estimated)	1948 :(estimated)
1. Cotton utilization investigations	\$866,450	\$949,700	\$963,900
2. Sweetpotato utilization investigations .....	147,862	166,295	168,600
3. Peanut utilization investigations	62,246	71,100	72,300
Unobligated balance .....	13,617	- - -	- - -
Total available .....	1,090,175	1,187,095	1,204,800
Anticipated supplemental .....	- - -	-111,230	- - -
Total appropriation or estimate..	1,090,175	1,075,865	1,204,800

Examples of Progress and Current Program:

Cotton Utilization Investigations:

Research on lint cotton is concerned with (1) finishes to improve the appearance and utility of fabrics made from low grade cotton, (2) special treatments of cotton textiles for rot- and weather-proofing, flame proofing, and water repellency, (3) development of wind and rain-resistant oxford-type fabrics, (4) improvement of cotton tire cord, (5) evaluation of commercial bleachery practices, and (6) fundamental studies of cotton cellulose and its derivatives.

Research on cottonseed is concerned with (1) improvement of the storage properties of the seed, (2) the chemistry of the pigments, (3) production of high-purity pigment gland fractions and of pigment-free meal for determination of nutritional or toxicological properties, (4) nutritive qualities of the gland-free meal, (5) study of the solvent extraction process for separating oil from protein, and (6) production of useful products from the oil and protein.

Finishes to Improve the Quality of Cotton Fabrics: At the present time the bulk of the cotton crop consists of short staple cotton. Fabrics made from low-grade short-staple cotton, such as part-waste osnaburg and 44x48 bag sheeting have been finished by commercially feasible finishing methods in the pilot plant with special reference to the production of durable and attractive fabrics. The usefulness of these fabrics, originally limited to bagging and similar low cost products, is thereby expanded to include garments, draperies, slip covers and the like.

Protection against Rotting: The excellent rot-resisting properties of partially acetylated cotton yarns, threads, and cloths, were announced in press releases. These announcements have aroused great interest, reflected in inquiries about the process and product, in requests for samples, or for the processing of the inquirer's own goods. A number of new uses have been suggested in the inquiries received. Some of these are: boat lining, seedbed covers, cloth bags for use in water-softening systems, bags for covering hams for overseas shipment, and electrical insulation in tropical climates.

While yarn and thread have been treated readily in moderate quantities, cloths of full widths in fairly large pieces have offered more difficulty; however, medium and heavy weight full-width piece goods in lengths up to 75 yards have been successfully processed on a dye jig. Cloth is being acetylated for larger-scale service tests in water-softening bags and for seedbed covers. An extensive service trial of cotton sand bags, rot-proofed with copper compounds, supplied valuable practical information about the relative effectiveness of various proofing agents in protecting cotton fabrics against biological rotting when exposed under severely degrading natural conditions. It also confirmed satisfactorily the dependability of accelerated soil burial as a method of selecting the most highly resistant rotproofing treatments. A final report on the test was made to the War Department and a summary of its more important features has been prepared for publication.

Protection against Weathering: To develop effective treatments for cotton textiles against the action of weather, both plain and chemically finished fabrics have been exposed, the latter group including representative pigment and other protective treatments, and a systematic examination has been made of the degradation occurring in the various samples. An attempt is being made to isolate, as far as possible individual factors in the composite of destructive forces found in weathering and to evaluate each of these in respect to its effect upon cotton cellulose. In this connection a detailed study of solar radiations is under way to determine the degrading action of different wave lengths upon fabrics finished by different chemical processes.

Among the various protective treatments so far examined, mineral-pigments such as lead chromate and iron tannate have appeared to be the most effective in resisting the destructive action of sunlight and weather on cotton cellulose. Since the color imparted to fabrics by application of such compounds may limit their range of usefulness, attention has also been given to the possibility of utilizing for protective purposes certain materials that do not noticeably color the treated fabric. For example, a form of urea-formaldehyde resin has been observed to retard the degradation of cotton exposed to carbon arc radiations and cloth treated with this compound is being tested for resistance to natural weather. Exposures are also being made of fabrics treated with other chemicals.



Flameproofing: Durable flameproofing treatments for fabrics for outer garments have been worked on and an emulsion process has been developed and tried out in a commercial finishing plant on 300 yards of cotton drill, demonstrating the feasibility of producing commercially flameproofed fabrics which will retain flameproof qualities during repeated launderings.

Water Repellency: A study of water repellency treatments for fabrics is underway. The effectiveness of organo silicon compounds has been variously reported and initial experimental work has been on the application of compounds of this class to cotton fabrics.

Wind- and Rain-Resistant Oxford-Type Fabrics: During the past year the development of improved wind- and rain-resistant oxford-type fabrics for civilian and Army use was undertaken in cooperation with the Office of the Quartermaster General. This broad project included: determination of fundamental relationships of moisture to cotton cellulose; study of changes in physical dimensions of fibers and yarns upon wetting; design of yarn and fabric construction; finishing treatment; and effect of variety.

From tests on experimental fabrics it has been found that improved water resistance may be attained in oxford-type materials by employing one or more of the following means: using mercerized yarn; addition of a swellable material to the yarn before weaving; and selection of a variety whose fibers swell more in contact with water than do those of common varieties.

Bleaching Cotton Textiles: Because of the variations in practices among commercial bleacheries a survey was made of 12 bleaching processes at 4 plants. Operating conditions were observed, numerous samples taken at various stages of processing, and physical and chemical analyses made. The report will guide future work on the improvement of bleachery practice.

Cotton Cutting Machine: The production test-runs on the two new disc-type cotton-cutter units and auxiliary equipment proved that the machine developed will cut lint cotton producing a product which can be converted into chemical cellulose by linters purification plants. With regular cotton and with certain practicable changes the expected capacity of 350 pounds per minute should be attained. As the emergency due to threatened shortage of linters has passed no further work on this subject is contemplated at the present time.

Cotton Cellulose and its Derivatives: Chemical and physical properties of derivatives of cotton cellulose are studied in order to understand the nature of cotton fiber and to utilize more fully its natural properties in developing treatments to improve appearance and utility.

Chemical treatments followed by mercerization have been devised, which produce relatively little change in the physical appearance of cotton fiber but change greatly the chemical properties. The swelling property of the resulting fibers having a low degree of substitution suggests application in production of improved rain-resistant fabrics, and research is underway to determine its practicability.

The optical behavior of dispersions or solutions of cellulose and substituted cellulose has been investigated in order to obtain evidence on the structure of these compounds.

Cotton Tire Cord: A broad coordinated program of research for developing an improved cotton cord has continued to be a major activity. Since the end of the War, objectives have been altered somewhat, primary consideration being given to the service requirements of cord in tires for civilian use.

In November 1945 the Bureau obtained release from War Department of data acquired during the War in fleet service tests of experimental tires.

Service and wheel tests are now underway on 9.00-20, S6, 10-ply cotton cord tires made with (1) Goodyear regular production cotton cord, (2) Wilds cotton cord produced according to Goodyear's regular process, and (3) Wilds cotton cord produced according to the dual-stretching process developed at the Southern Laboratory. A similar set of rayon cord tires is being run along with the cotton tires to obtain comparative data on "growth", tread-wear, and operating temperatures.

A ply-building machine is being constructed for preparing tire plies for use in connection with the manufacture of tires for small-scale wheel and road tests. Use of this ply-building machine will greatly facilitate production of sample tires for the wheel and service testing phase of the tire cord research program.

A study was made of the effect of moisture and temperature on the properties of tire cords. It was found that, in general, moisture content over the ordinary ranges has a much greater effect on elastic properties than does temperature up to 145° C. The extension of this investigation to higher cyclic rates of loading is expected to give further fundamental data useful in developing improved cotton tire cords.

Research has been continued on the influence of cord construction on cord properties. Using cords made from three different staple lengths of cotton (1", 1-3/32", 1-3/8"), it has been determined that the amount of twist in the single yarns is a relatively unimportant factor in regard to strength and flex-life, but that a slightly higher ply-twist than is customarily used commercially gives greater flex-life. This research is being continued with 1-3/8" Wilds cotton over a wider range of construction in order to establish more general relationships between cord construction and cord properties.



Preliminary research has been completed on the chemical degradation of the cellulose of cotton cord during tire manufacture and during road and wheel testing of military tires, made from commercial cotton cord and from Wilds cotton cord. Additional research on the influence of heat on chemical degradation of the cellulose is in progress.

Separation of Pigment Glands of Cottonseed: Microscopic investigation of the nature and distribution of the predominant pigments in cottonseed tissue has shown: pigments are concentrated in distinct organs of the seed, that is, in glands; these glands are mechanically strong, resist the action of many organic liquids, and have a density less than other cottonseed tissue. Based on this information pre-pilot plant research has been conducted to develop suitable equipment for obtaining relatively pure pigments and pigment-free meal. With the set-up devised, undefatted cottonseed flakes yielded up to 2.9% pigment glands, on an oil-free moisture-free basis, with the final pigment gland fraction 85 to 90% pure.

For many years research has been conducted by various groups on the chemical, physical, nutritional and toxicological properties of cottonseed and cottonseed products, and their constituents. The many discrepancies in the reports have not been fully explained or understood. But now, with relatively pure substances available for study, it is to be expected that more conclusive investigations may be conducted which will lead to extended utilization of cottonseed.

Improving Storage Properties of Cottonseed: Investigations have been conducted on: (1) nature and behavior of the enzymes present in cottonseed, (2) the selection by a laboratory sorting test of chemical compounds which exhibit biochemical activity and which should be tested on a larger scale to determine commercial feasibility, and (3) mill-scale storage tests.

A relatively rapid procedure has been developed for determining the biochemical activity of chemical compounds, using flaxseed as a diagnostic material because it is easily handled and responds uniformly to chemical treatments.

Mill scale storage tests on moist cottonseed were conducted during the 1945-46 season to determine the efficacy of using a commercial detergent. Since only slight beneficial effects were obtained, further work on this type of compound has been stopped.

Solvent Extraction of Cottonseed: The pilot plant scale for the development of feasible commercial means for processing cottonseed by solvent extraction is nearly completed. Meanwhile specific problems relating to solvent extraction have been studied. The effect on oil quality of heating oil-miscellas to different temperatures for various lengths of time has been determined on oils obtained by solvent extraction and by hydraulic pressing. Heating for 1 hour to 210° F. had little effect on



either oil. The gossypol content of solvent extracted cooked flakes was only one-tenth that of solvent extracted uncooked flakes, as determined by two methods. For feedstuffs the latter would probably require further detoxification although it would be more desirable for industrial use where undenatured protein was required.

Cottonseed Oil Investigations: The role of tocopherol as an antioxidant for improving the keeping quality of cottonseed oil has been investigated further. Alkali refined and bleached cottonseed oils of varying degrees of hydrogenation were compared with hog and chicken fat, which are tocopherol free.

For developments relating to fractional solvent crystallization and investigations to improve utility and industrial application of cottonseed oil refer to Peanut Utilization Investigations.

Summary of the Work on Cotton: Method has been developed for the finishing of fabrics from low-grade short staple cotton suitable for garments, draperies, etc.

Potential use of cotton fabrics for boat lining, seedbed covers, etc. is promised by an acetylation treatment. Results of study of relation of solar radiations to deterioration of cotton fabrics should help in developing new treatments. Methods of improving water resistance of oxford-type materials have been developed. Testing of a cotton fiber cutting machine developed by the laboratory has been completed.

Additional fundamental information on the chemical and physical properties of cotton cellulose and its derivatives has been developed.

A machine is being constructed for use in preparing tire plies for experimental tires. Wheel tests of tires with various cotton fabrics are being made and, for comparison similar tests are being made on rayon cord tires. Data on specification of an improved cotton tire cord are being obtained.

Pigments other than gossypol in cottonseed have been isolated and identified. A complete pilot plant for solvent extraction of cottonseed is nearly completed.

#### Peanut Utilization Investigations:

Research at the Southern Laboratory on peanut utilization investigations is concerned with (1) improving the keeping quality of peanut oil, (2) pilot plant research on modification of oil by low temperature fractional solvent crystallization, (3) basic properties of meal and protein, (4) adhesives from meal and protein and (5) protein fiber production and processing.

Improving the Keeping Quality of Peanut Oil: The effectiveness of a number of chemicals for improving the keeping quality of peanut oil products was determined. Some of the compounds were also tested on cottonseed oils. Although 0.1% of proline more than doubled the stability of the oils tested, the objectional odor associated with it cannot be removed by steam deodorization, which militates against its use in edible oils. As judged by the active oxygen method conidendrin was inactive but 0.5% of bisnorconidendrin increased the keeping quality of edible grade peanut oil by about 4-fold and that of antioxidant-free oil by 15-fold.

Low-Temperature Fractional Solvent Crystallization: The equipment for carrying out this type of oil or fat processing may be applied to a number of problems; one being the "winterizing" of peanut oil, which will increase its utility and permit its use in salad dressings and mayonnaises. The commercial chilling process applied on cottonseed oil cannot be used on peanut oil so a method using solvents was devised which was successful on a laboratory scale.

During the fiscal year 1946 the installation of equipment for research on low-temperature fractional solvent crystallization on a pilot plant scale was completed and operated in a series of 10 experimental runs using refined peanut oil with operating conditions systematically varied.

Basic Properties of Meal and Protein: Several short-term investigations have been completed that dealt with problems encountered in broad projects on extended industrial utilization of peanuts.

The oven-loss-in-weight methods for the determination of moisture in peanuts were reexamined and a simpler more reliable procedure proposed. A method for the determination of inorganic phosphorus in plant material was developed in connection with work on phytin in peanut and peanut products.

The compounds xanthine, guanine and adenine have been found in the effluents from the preparation of protein from solvent-extracted peanut meal, in a study to get information on the fate of protein constituents during processing.

Adhesives, Coatings and Sizes: Peanut protein isolated under conditions that produce a minimum of denaturation is suitable for the preparation of tacky hydrate adhesives which have sufficient strength for gluing paper or cardboard as in book binding or in the manufacture of set-up boxes. Being tacky at room temperature it can be applied cold, an important factor in accelerated commercial operations. Peanut protein can also be used in adhesives for gummed paper tape and possesses the desirable property of not becoming tacky in humid atmospheres.

These preparations have insufficient strength for use in holding mineral pigments to coated paper or in protein-containing water-paints for interior surfaces. It was found however, that a good quality product could be obtained by treating a protein solution with sodium hydroxide (10% dry basis) and allowing to stand overnight at room temperature, i.e. 25-30° C. Substitution of sodium peroxide for part of the sodium hydroxide yields a protein lighter in color.

Fiber Production and Processing: Peanut protein fiber research has been continued with overall results indicating continued improvements in properties of the yarn produced and with increasing assurance that a commercially valuable fiber can be produced.

Certain properties of the fiber, in relation to those of wool, have been studied and it has been demonstrated experimentally that it is feasible to blend the fiber with natural wool prior to subjection of the mixed yarn to the commercial treatment known as carbonization, a process used to remove cotton and other cellulosic materials.

Summary of the Work on Peanuts: A stabilizer capable of increasing the keeping quality of peanut oil 15-fold is being investigated.

A further improved peanut protein adhesive suitable for bookbinding and set-up boxes as well as for gummed paper tape has been developed. Fiber research has been continued with over-all results indicating continued improvements in properties of the yarn produced.

#### Sweetpotato Utilization Investigations:

Research at the Southern Laboratory on sweetpotato utilization is concerned with (1) translating to industrial scale the Bureau's processes for manufacture of sweetpotato starch, (2) improvements of processes for recovery of starch from sweetpotatoes, (3) production of feed yeast and other useful products from the effluents of starch manufacture, and (4) dehydration of sweetpotatoes for food and feed.

Industrial Development: Shipment in December 1945 of the first car of sweetpotato starch from Florida's new farm-crop production-and-marketing enterprise marked another milestone in the advance of southern agriculture and industry. The plant has a capacity of 120 tons of finished starch per day and when in full production will turn out 50 million pounds or more per year.

This plant is the outgrowth of 15 years of research and development work by the Bureau in the field of industrial processing of sweetpotatoes. Technical advice and assistance was given during test runs and initial production operations in the adjustment of processes and equipment, and the development of chemical control in the various stages of processing.



Sweetpotatoes have been grown for the manufacture of starch and feed since 1934 when the Bureau began to demonstrate at a Laurel, Mississippi plant that a high-quality white starch could be made from sweetpotatoes. The starch produced at Laurel has been favorably received by the cotton mill, the laundry, and the food and dextrose industries.

Sweetpotato Starch Manufacturing Process and Control: An automatic device for accurate sampling of input material in commercial operations has been built and tested on a laboratory scale. During the processing of the 1946 crop it will be tested in a commercial plant. Preliminary investigations were begun to compare the performance of hammer-mills, attrition mills, and drum rasps, as primary grinders for disintegration of sweetpotatoes for starch. Results to date with two attrition mills gave results quite similar to that obtained with hammer mill grinding, in respect to particle size distribution in the ground pulp, extraction and recovery of starch, or proportion of very fine pulp produced.

In continued laboratory investigations the progressive reduction in paste viscosity during acid modification at constant temperature was followed at different concentrations of acid, with a series of sweetpotato starches representing different original paste viscosities and different case histories as to manufacturing conditions. The effects of minute amounts of inorganic salts which often carry over into the finished starch in variable amounts also received consideration. Data not hitherto available were obtained to guide uniform production of acid modified sweetpotato starches of definite specifications.

The results of preliminary investigations on a sub-pilot plant scale encouraged the prospect of developing a simplified process for extraction of sweetpotato starch which would be adaptable to small-scale plants of relatively low capital investment and low operating cost and which would turn out products of a quality suitable for at least some of the important applications of sweetpotato starch. The development of low cost units would meet the requirements of large farm or community sweetpotato producing enterprises and afford opportunity for diversification of their crop. More intensive prosecution of larger scale experiments along this line has begun.

Byproducts of Sweetpotato Starch Manufacture: Large scale pilot plant research has been carried out on a continuous process for production of feed yeast from sugars in starch process waste waters.

Yields of yeast equivalent to 45% and more of the sugars present were obtained. Continued laboratory investigations have been made to ascertain the most effective and economical nitrogen supplement for yeast propagation. Vigorously growing yeast practically precludes foreign contamination.

Further trials have confirmed previous findings that yields of yeast from

starch fruit water were as large in the presence of acid- and heat- flocculated crude protein as when propagation had been carried out after the removal of the coagulum. Thus the natural protein and the yeast could be concentrated and recovered simultaneously. Further trials on the use of the Merco high-speed continuous centrifugal for concentration of the yeast suspension or the combined yeast and protein suspension indicated the need for careful adjustment of the operating conditions if the equipment is to be successfully adapted to this purpose.

Investigations of the crude protein recoverable from sweetpotato starch process waste waters has been essentially completed. Previous findings as to the identity and content of specific amino acids have been confirmed and, in addition, methionine and cystine have been identified and determined in amounts of about 1.7% each. The protein appears to be of good nutritional value from the standpoint of amino acid composition.

Dehydration of Sweetpotatoes for Food Use: Continued technical advice and assistance were rendered Sweet Potato Growers, Inc., in connection with dehydration of sweetpotatoes for food use at their plant in Laurel, Mississippi. A continuous rotary preheater was designed by the Southern Laboratory for elevating the temperature of the sweetpotatoes before peeling in order to curb discoloration due to catecholoxidase reaction. When the Laurel plant installed equipment of this design blackening was practically eliminated, and the former bottleneck at the trim table was eliminated.

Summary of the Work on Sweetpotatoes: The sweetpotato starch plant, using the starch production process developed by the Bureau, has started commercial production.

A continuous process for the production of feed yeast from sugars in starch process waste waters has been tested on a pilot plant scale with favorable results. The method is being tested for production of yeast from citrus juice wastes by a commercial concern.

Western Regional Research Laboratory

PROJECT STATEMENT

Project	1946	1947 :(estimated)	1948 :(estimated)
1. Alfalfa utilization investigations ..	\$31,548	\$36,725	\$37,320
2. Fruit, including apple, utilization investigations a/ .....	297,909	359,980	442,800
3. Poultry utilization investigations ..	235,529	280,835	206,930
4. Vegetable, including potato, utilization investigations a/ .....	362,163	428,425	435,300
5. Wheat utilization investigations b/ ..	70,853	86,330	87,650
6. Tanning materials - western hemlock bark as an emergency source .....	7,873	- - -	- - -
Unobligated balance .....	87,800	- - -	- - -
Total available .....	1,093,675	1,192,295	1,210,000
Anticipated supplemental .....	- - -	-111,230	- - -
Total appropriation or estimate ...	1,093,675	1,081,065	1,210,000

a/ - Joint project with Eastern Regional Research Laboratory.

b/ - Joint project with Northern Regional Research Laboratory.

Examples of Progress and Current Program:

Alfalfa Utilization Investigations:

The Western Regional Research Laboratory has three major interests in the utilization of alfalfa: (1) the furtherance of dehydration as a means of processing alfalfa meal, (2) the retention of protein and carotene in dehydrated alfalfa meal during storage, and (3) the efficient and economic extraction of carotene and chlorophyll, substances in demand in the fields of medicine and industry.

Alfalfa, a half-billion dollar crop in 1945, has increased almost two-fold in economic importance since World War I. Of the 33,671,000 tons of alfalfa harvested in 1945, approximately 826,000 tons were marketed as alfalfa meal. Approximately 454,000 tons of this meal were processed from sun-cured alfalfa, and approximately 372,000 tons were processed in the form of dehydrated meal. Since dehydrated alfalfa meal sells at a premium of ten dollars a ton over sun-cured alfalfa meal, it can be readily calculated that for every increase of 100,000 tons in the production of dehydrated meal an additional million dollars of agricultural income has been created.



Dehydration. Because of its intensive and successful work in the designing of dehydration equipment during World War II, the Western Regional Research Laboratory was in an ideal position to provide valuable assistance to the alfalfa dehydration industry. The extent to which assistance was given is attested by the many requests for technical advice which were fulfilled. To serve the industry further a survey of plants in operation, their location, their individual output, the quality of the product, and the availability of dehydration equipment has been made. This economic information has been of distinct value both in answering correspondence and in keeping in contact with the industry.

Storage. To preserve the carotene and protein contents of dehydrated alfalfa meal in storage two lines of investigation are being undertaken. The addition of antioxidants has been shown to be effective in prolonging storage life at room temperature. Studies of the possible relationship of fatty and other minor constituents to degradative changes during storage are now in progress. Alfalfa growers, poultry producers, and the dehydration industry are following this work with warm interest.

Source of Carotene and Chlorophyll. Development of methods for the economical extraction of carotene and chlorophyll for use in medicine and industry is another aspect of the alfalfa work. If the carotene can be extracted cheaply, a rich source of supply is available in alfalfa. Studies have been continued on the improved method of carotene extraction developed in this Laboratory and the first phase of this work has now been accomplished. The next phase, making the method economically practicable, is now receiving attention. Chlorophyll has found additional commercial use as a deodorant. As an air freshener for public gathering places and industrial plants its widespread acceptance can be forecast. Chlorophyll, now employed as coloring matter for foods, soaps, and pharmaceuticals, is abundantly present in alfalfa. Studies on methods of extraction of chlorophyll from alfalfa have progressed to the point of investigating the commercial application of the method.

Summary of Work on Alfalfa. Value of the work on dehydration is indicated by the ready adoption by industry of information made available. Satisfactory progress on improving methods of storage has been made. Methods of extraction developed by the Laboratory are ready for commercial evaluation.

#### Fruit Utilization Investigations:

From the establishment of this Laboratory in 1940, the research on fruit has been devoted to the prevention of economic losses occasioned by the waste resulting from seasonal surpluses as well as sound but overripe and cull fruit and that which is incidental to canning or other forms of processing. Some of the successful means developed by the Western Regional Research Laboratory to prevent such wastes are: (1) a process for producing Velva Fruit, a frozen fruit puree named and developed by this Laboratory;

(2) principles and improved methods for the dehydration of various fruits, and (3) a process for making a jelly-like fruit salad utilizing pectin. Velva Fruit has found wide use in salvaging fruit too ripe to ship or fruit blemished in minor degree; its commercial production has been high, one firm alone having merchandised over 75,000 gallons monthly. Home production has been extensive enough to warrant the publication of a leaflet explaining the process. Dehydrated fruits, which were procured by the Quartermaster Corps during the recent war in quantities of millions of pounds were indirectly benefitted by the application of principles of dehydration developed at this Laboratory; with regard to dehydration plants processing Northwestern apples and California raisins, the dehydration studies of this Laboratory were of direct aid. Over 25,000,000 cans of the fruit salad developed by this Laboratory were procured by the Quartermaster Corps for consumption by troops at home and overseas. The salad was held in high favor as a dessert item on the Army menu, and its acceptance by civilian consumers can be expected.

Current research is yielding equally successful results. Apple and citrus wastes, for example, can be utilized by a method developed at the Western Regional Research Laboratory which simplifies and reduces the cost of producing low-methoxyl pectin. Pear waste as a medium for Torula yeast production has been undergoing pilot plant study at Olympia, Washington, and the Laboratory has demonstrated the product of these operations to be a vitamin-rich, protein feed suitable for livestock. Surplus fruits can be turned to commercial use by various methods developed at this Laboratory; (1) a method of spray-drying which processes fruit juices into a fruit powder, (2) by a cold-process method for making jelly resulting in maximum flavor retention, and which eliminates the usual heat treatment of the fruit, and (3) by dehydrofreezing, a new method of preservation which developed out of the Laboratory's extensive work on dehydration during the war and its work on the preparation of frozen products. A closer view of each of the foregoing contributions to the economy of the fruit industry follows.

Low-methoxyl Pectin. By co-operative agreement with a commercial firm, low-methoxyl pectin is being produced from citrus waste at Chino, California, in a pilot plant designed by the Western Regional Research Laboratory. Since the pilot plant stage of our projects provides the final and practical appraisal of our research, it may now be said that low-methoxyl pectin can be produced from citrus waste at a cost materially below the present commercial cost. The Laboratory's continuous process eliminates the use of alcohol, one of the most expensive items in the commercial extraction of pectin. Better than 90 percent recovery is being obtained. The value of a cheaply produced low-methoxyl pectin is manifold. From 30 to 35 percent of the sugar used in making jellies can be omitted by the use of this type of pectin. When it is considered that some 15,000,000 pounds of sugar is used in the Western jelly pack alone, it can be seen at once that the use of low-methoxyl pectin would effect a saving of nearly 5,000,000 pounds of sugar, a commodity now in extreme shortage. More important,



however, is the fact that the cost of producing jellies, jams, and puddings would be reduced by the use of low-methoxyl pectin, doubtless leading to considerably increased consumption of jelly.

But jelly is only one of the uses to which low-methoxyl pectin might be put. As a substitute for gelatin, widely used in the manufacture of cold meats and fruit desserts, it would find an active market. Pharmaceutical uses are also in prospect.

As a thickening and jelling agent in candies of the gumdrop type and as a filling for chocolate covered candies, low-methoxyl pectin has aroused great interest in the confectionery trade.

The use of fruit powders in the making of desserts, puddings, jellies and marmalades, would extend the market for these commodities materially. A cold-process pudding which utilizes pectin has met with much favor when sampled by taste panels and Laboratory visitors. That the formula for making a cold-process jelly, soon to be released, will be well received by commercial as well as home producers is indicated by the interest already shown.

Feed Yeast from Wastes. The severe shortage of protein feeds makes the production of Torula yeast from pear wastes a valuable research project. Torula yeast is being manufactured on a pilot plant scale at Olympia, Washington, with equipment designed by this Laboratory. Test runs have demonstrated the commercial feasibility of preparing a satisfactory fodder from pear wastes, and it was the opinion of observers of the tests that the yeast fermentation and drying aspects of the process are ready for industrial application. Full utilization of the waste pomace is required before the process is accepted by the industry as economical, but that problem, is on the way to being solved. In the Laboratory the quality of the product has been tested, and there is assurance that it will prove to be a satisfactory protein feed.

Dehydrofreezing--New Method of Food Preservation. Of the various preserving methods developed or in the process of development at the Laboratory for the alleviation of the fruit surplus problem, a new method called dehydrofreezing is attracting wide commercial interest. Results of studies on dehydration, a wartime assignment of the Laboratory, have found further application in the development of this method. Under dehydrofreezing, fruits are dried through the first stage of dehydration and then frozen. The first stage of dehydration removes the water from fruit juices but leaves virtually intact the flavor and nutritive components. Reconstitution is not difficult and dehydrofrozen products retain fresh-quality character in storage. The advantage of the process lies in salvaging excess quantities of fruits and vegetables for postseasonal use. Because of their convenience, dehydrofrozen products should be well adapted to the needs of commissaries of large institutions, and decreased storage and refrigeration costs should provide a special appeal to those charged with managing the budget for food.



Since dehydrofreezing reduces weight and volume by approximately 50 percent, transportation costs would be cut correspondingly. The cost of transporting frozen products by air would be distinctly decreased by this method of preservation, and thereby new markets in less accessible regions might be found.

The pack of frozen apricots in California alone has increased from 55,000 lbs. in 1940 to 34,800,000 lbs. in 1944 and that of peaches from 97,000 to 22,700,000 lbs. Most of these frozen fruits were used in pies. A large share of them were treated with a sodium bisulfite bath using a procedure developed at the Western Regional Research Laboratory. During the past year an improvement was made which resulted in greatly speeding up the penetration of sulfur dioxide into the fruit.

Experimental packs prepared are very promising. The process used is as follows:

1. A short (45 sec.) steam blanch to inactivate skin enzymes.
2. A sodium bisulfite solution dip.
3. A dip in a solution of 1 percent ascorbic acid and 2 percent salt.
4. Submerging in a sugar syrup containing ascorbic acid.

Less than half the sulfur dioxide (from sodium bisulfite dip) was required. The flavor was better and removal of sulfur dioxide easier. The steam blanch is so short that it does not cause a cooked flavor, soften the fruit or entail a significant leaching loss. Salt and ascorbic acid have a mutually beneficial action in this application. The suggested dip will prevent darkening for from four to six hours after defrosting in either apricots or halved peaches. The process outlined above is an improvement over previous methods which processors agree are not entirely satisfactory.

Summary of Work on Fruit. The Laboratory's continuous process for the production of low-methoxyl pectin reduces the cost of this increasingly important product. Test pilot plant runs have demonstrated the commercial feasibility of preparing a satisfactory fodder from pear wastes. Dehydrofreezing, a new method of food preservation, is attracting wide commercial interest, and gives definite indication of advantages over either the usual quick freezing or dehydration processing methods.

#### Poultry Utilization Investigations:

Research on the utilization of wastes incident to poultry or poultry byproducts has yielded the following representative results: (1) a method for the effective control of acidity during the drying and storing of eggs whereby the shelf life of the product is extended fourfold;

(2) the detection of the components responsible for loss of palatability during storage of dried eggs; (3) the determination of the cause of the objectionable brown color that develops in dehydrated eggs during storage; (4) the finding of antioxidants that are suitable for use in prolonging the storage life of dried eggs; (5) the development of a quick, simple and inexpensive test for detecting high bacterial count in frozen eggs; (6) a new method for isolating the antibacterial agent, lysozyme, from egg white; (7) the study of molecular size and configurations of dispersed chicken feather protein (Keratin), data which will be useful in the manufacture of fibers, plastics, and adhesives from this source; and (8) improvements in the processes of stretching and curing of fiber derived from Keratin, which effect an increase in the wet strength of the fiber three or four times that formerly attained. Detailed accounts of each of the foregoing advances in the work on utilizing poultry wastes follow:

Storage of Dried Eggs. A series of experiments and tests designed to find a means of extending the useful shelf life of dehydrated eggs demonstrated mildly that acidifying the broken-cut eggs with hydrochloric acid before drying and then mixing with the dry powdered eggs a quantity of sodium bicarbonate sufficient to neutralize the acid assures a useful storage life three or four times greater than was formerly obtainable. The beating properties of the product thus treated are essentially equal to those of fresh eggs. Prolonging the storage life will react to extend the market for dried eggs inasmuch as stability is basic to their commercial usefulness. The market for dried eggs is still far above pre-war figures, which indicates that the commercial demand for this product will continue. The gradual loss of palatability of dry powdered eggs in storage has restricted their use. Evidence obtained by the Western Regional Research Laboratory indicates that two types of chemical change contribute to the loss of palatability and formation of objectionable brown color in stored egg powder. Progress is being made in minimizing such deterioration and it is believed remedies will be devised ultimately. The search for a means of prolonging the storage life of egg powders has been rewarded in another way; namely, by the discovery that the amino acid proline is an effective antioxidant. Further search will doubtless reveal other additives suited to prolonging the life of dried eggs in storage.

The frozen egg industry, which has been increasing steadily in size and output, will benefit by the development of a new test, which is quick, and cheap, for determining the quality of frozen eggs.

Antibiotics. Not only can antibiotics be isolated from cultures of microorganisms grown on crop wastes, but they can also be extracted directly. Such is the case with lysozyme, a bacteria-destroying enzyme contained in egg whites. The method for preparing pure crystalline lysozyme as developed at the Western Regional Research Laboratory is adaptable to commercial use, and it is possible that the waste egg white adhering to egg shells will be utilized eventually within the freezing and drying plants themselves.

Chicken Feathers. Progress has been made in the project for utilizing the keratin component of chicken feathers. Keratin protein can be processed to form an excellent spinnable fiber, but that fiber has been of somewhat limited value because of its vulnerability to moisture. Improvements have been effected, however, whereby elements are built into the structure of these feather fibers that increase their wet strength three or four times.

Since about 24,000 tons of poultry feathers go to waste annually in the United States, an effective method of converting them into fiber offers a substantial additional income to the poultry industry. There is plenty of room for new fibers in industry, and because feather fibers have special properties - among these, curl and resiliency - they fit admirably the requirements of such special products as minikin wigs, for which there is a sizable potential market.

Summary of Work on Poultry. Useful storage life of dried eggs three to four times greater than formerly obtainable promised by improved technique in drying. Proline found to be effective antioxidant. Waste egg white adhering to egg shells source of pure crystalline lysozyme, a bacteria-destroying enzyme. A synthetic fiber with increased wet strength has been produced from the keratin protein of chicken feathers.

#### Vegetable Utilization Investigations:

The current program of research devoted to the utilization of vegetable wastes includes: (1) the development of a method of isolating the antibiotic, subtilin, from B. subtilis culture liquors for the production of which asparagus butt juice can be advantageously used as the base; (2) the development of methods for the isolation of other antibiotics, for example, gramicidin, the more active component of another antibiotic, tyrothricin; (3) storage studies on various dehydrated vegetables; (4) studies of problems involved in the spray drying of vegetables to produce vegetable powders; (5) experimental work with a rotary peeler designed by the Laboratory to improve the chemical peeling of vegetable as commercially practiced; (6) studies in the freezing preservation of corn, peas, and tomato juice. Detailed accounts of this work follow:

Antibiotics from Wastes. Since the epochal discovery of penicillin, great interest has been shown in other antibiotics, among them subtilin, tyrothricin, and gramicidin. The contribution which the Western Regional Research Laboratory can make in this connection is two-fold. It will aid growers and processors by providing for the utilization of an otherwise waste material, which is now a troublesome disposal problem in processing plants; and it will aid the pharmaceutical industry by the assurance of an ample supply of culture liquor in which subtilin and other antibiotics can be grown.



To produce antibiotics on a commercially profitable scale, the culture medium must be both cheaply and readily obtainable. It has been demonstrated that the Western Regional Research Laboratory method for the extraction of juice from asparagus butts meets these two requirements. The process was brought to a semi-plant scale and further work can now be carried on by commercial interests. The cost of production, about 7¢ per pound, is similar to costs of other media. Since 27,000 tons of asparagus waste is annually available in California alone, the return that might be derived from converting this material to culture liquor for growing subtilin would be material.

Evaluation of subtilin, the end product of the culturing procedure, is being made by the University of California under a cooperative agreement. The Western Regional Research Laboratory has been supplying the cooperator with the desired amounts of the antibiotic. The prospects that it will be useful in the treatment of tuberculosis and amoebic dysentery, diseases that have resisted most other treatments, are sufficiently bright to warrant the intensive efforts of the Laboratory to develop the production and recovery of this antibiotic.

The more active component of tyrothricin, gramicidin--which has shown great promise as a chemotherapeutic agent--is also produced with asparagus juice as the medium.

Packaging of Dehydrated Vegetables. Of particular interest with regard to the storage of dehydrated vegetables are the results of experiments with lime as an in-package desiccant. It has been found that very low moisture content can be maintained by this means. At temperatures as high as 90° and 100° F., samples of dehydrated vegetables remain palatable for 18 months or more. Although the project was originally a wartime assignment, the findings will be applicable in commercial operations. Much interest has been shown by the industry in this method of prolonging the life of dehydrated foods storage.

Spray-dried Vegetable Powders. The spray-drying of vegetables to form vegetable powders has been studied further, and progress has been made in developing means of elevating the so-called sticky point, the point at which powder particles tend to adhere. The employment of additives is accomplishing for spray-dried tomato powder and some others the desired purpose--the production of a free-flowing powder. The commercial use of vegetable powders for the preparation of soups, sauces, and beverages is potentially great.

Rotary Peeler for Vegetables. A laboratory-size rotary peeler, designed by the Laboratory for experimental use with potatoes, carrots, and other root crops, was procured and installed. Preliminary experiments indicate that the rotary peeler has definite advantages over present commercial equipment, and further experiments and tests are being conducted.

Freezing Preservation. The wide interest in the freezing preservation of vegetables, both home and commercial, makes the studies on frozen corn, peas and tomato juice of particular significance. Among many projects looking toward the improvement of frozen products, the Laboratory undertook experiments to determine the cause and the remedy for off flavors in frozen peas. On the hypothesis that the aldehydes may be the offending compounds aldehyde determinations were made which show a correlation between the aldehyde content of samples and the off flavor present, suggestive of a useful line of attack on this difficult problem.

To the foregoing items that indicate the definite progress of the program, there should be added the application of dehydrofreezing to the preservation of vegetables. Since this method is described in some detail under the report on fruit investigations, it will only be stated in the present section that dehydrofreezing may be expected to extend the market for many vegetables and thus provide another means of utilizing surpluses.

Summary of Work on Vegetables. Results on evaluation of subtilin produced by the Laboratory as an antibiotic in treatment of tuberculosis and amoebic dysentery under cooperative arrangements with University of California are promising. A free-flowing spray-dried tomato powder has been produced by employment of additives.

#### Wheat Utilization Investigations:

A general view of the work done by the Laboratory to utilize wheat waste or surpluses may be had by considering the following representative accomplishments: (1) the development from gluten rubber-like product which may have use as a material for printers' rolls; (2) the development of a new and improved method for determining glutamic acid; (3) an improved production process for gluten sulfate; (4) a continuation of basic chemical studies on gluten sulfate, the most productive of which is research on its possible use as a detergent, emulsifying agent, and the like; and (5) studies on glutenin, which revealed that gluten is formed during the kneading of bread.

In fuller detail, each of the foregoing may be described as follows:

#### Wheat Gluten Products.

- (1) The gluten-glycerol product has excellent oil, grease and hydrocarbon solvent resistance, which indicates its use in printers' rollers. It, however, is not water resistant.
- (2) Glutamic acid finds use as a synthetic meat-like flavoring for dried soups and other food products. It is also being used in synthesizing a new vitamin, folic acid, and its usefulness to the pharmaceutical industry will parallel the value of that vitamin in medicine.

- (3) and (4) Industrial interest in gluten sulfate is continuing. This gel-forming reaction product derived from wheat gluten and sulfuric acid probably will find its chief usefulness in the food industry, but the pharmaceutical and other industries have expressed interest. Unlike the sulfated derivatives of most proteins, gluten sulfate is insoluble, and attention is being given to its possible use as a detergent, emulsifying agent, etc.
- (5) The value of fundamental studies on gluten protein composition lies in their contribution to the finding of end uses for gluten. The knowledge that gluten is formed during the kneading of bread, for example, may be of great importance in the solution of problems that arise in the baking industry.

Summary of Work on Wheat. A gluten-glycerol reaction product has been produced that gives indication of being useful in the manufacture of printers' rolls. Information developed on the method of production and properties of gluten sulfate has led to industrial interest in this product for use in the food, pharmaceutical, and other industries.

Eastern Regional Research Laboratory

PROJECT STATEMENT

Project	1946	1947 :(estimated):	1948 :(estimated):
1. Apple and other fruit utilization investigations <u>a/</u> .....	118,907	133,200	135,600
2. Vegetable utilization investigations <u>a/</u> .....	78,930	89,300	90,900
3. Tobacco utilization investigations .....	183,600	209,500	213,100
4. Milk products utilization investigations .....	277,529	321,405	326,200
5. Animal fats and oils utilization investigations .....	224,619	252,400	256,500
6. Potato utilization investigations <u>a/</u> .....	88,033	98,800	100,600
7. Tanning materials, hides, skins and leather utilization investigations .....	76,691	85,700	87,200
Unobligated balance .....	36,566	- - -	- - -
Total available .....	1,084,875	1,190,305	1,210,100
Anticipated supplemental .....	- - -	-118,040	- - -
Total appropriation or estimate ..	1,084,875	1,072,265	1,210,100

a/ - Joint project with Western Regional Research Laboratory.



Examples of Progress and Current Program:

Apple and Other Fruit Utilization Investigations:

Current research activities on this project include the following lines of investigations: (1) Pilot-plant scale operation of the apple essence recovery process reported last year, to determine the varieties of apples which yield a commercially satisfactory product. (2) Studies on the effect of different methods of processing on the quality and stability of apple juice. (3) The application of apple essence in the preparation of a true-flavored apple candy. (4) Chemical composition studies of apple essence. (5) Study of factors influencing the yield and quality of pectin from apple pomace. (6) Development of methods for "firming" McIntosh and other soft textured apples which cannot now be used satisfactorily for freezing purposes.

Apple Essence. The process for the recovery of the volatile flavoring constituents of fresh apple juice, which was developed in 1944, was brought to successful commercial adoption during the past year. Nine companies have installed units for the recovery of apple and other fruit essences.

Natural apple essence was produced in the pilot plant from nine varieties of apples. Essence from each variety has its own characteristic aroma which follows closely the individual character of the apples from which it was produced. Essences from McIntosh and Delicious apples (Red or Golden) were excellent. The Rhode Island Greening essence on the other hand was definitely poor.

Essence from Other Fruits and Berries. Through the cooperation of a preserve manufacturer who installed a pilot plant flavor recovery unit based upon our recommendations, various fruit and berry juices were processed experimentally to determine the conditions for essence recovery, character of the essence and possible use in the preserve industry. It appears from these preliminary experiments that although true fresh fruit essence can be prepared from a wide variety of juices using the process developed for apple juice, this particular method of stripping and reincorporation of the essence is not applicable to the preserve industry.

Pectin from Apple Pomace. Seventy samples of apple pomace were obtained from various processing plants which prepare dry pomace by three well-known commercial methods. In all cases a sample of fresh pomace was collected and immediately dried in a portable laboratory drier for comparative purposes. Preliminary tests indicate that the length of time the wet pomace stands before being dried is a very important factor in pectin quality. Other factors which may affect pectin quality are being investigated.

Enzyme Deesterified Pectin: An improved method has been developed for the preparation of low-ester pectin by enzymes. The product is comparable in quality to an acid-deesterified pectin, having good solubility, high gel strength and low calcium sensitivity. Approximately 25 pounds of this low-

ester pectin has been prepared and samples distributed to commercial firms interested in its manufacture or utilization. As a result of the simplifications in the process and the high quality of the product, two companies are planning to begin manufacture in the near future.

Summary of Work on Apples. The recovery of the volatile flavoring constituents of fresh apple juice has been adopted commercially; nine companies have installed equipment for the production of apple and other fruit essences. A number of varieties of apples have been evaluated for the quality of essence recovered. Through a cooperator, pilot plant scale application of the essence recovery method has been made to various other fruits and berries. Improvements have been made in the method of producing low-ester pectin from apples through enzyme deesterification and the product is being evaluated by commercial firms.

#### Vegetable Utilization Investigations:

Past work on this project has demonstrated the value of many vegetable wastes in poultry feeding. Practical methods for drying such wastes with minimum vitamin losses as well as the preparation of leaf meal concentrates were developed. Both the Laboratory and pilot plant investigations on this phase of the project may be regarded as completed, current activity being centered almost entirely on the industrial use of the processes involved. Other research on the utilization of vegetables now includes the following: (1) Studies on the composition of the lipids occurring in vegetable wastes. (2) Isolation and analysis of the leaf proteins of vegetables. (3) Development of methods for the recovery of carotene, tocopherol and other valuable components of vegetable wastes. (4) Studies on the production of rutin from buckwheat.

Rutin from Buckwheat - Commercial Production. During the summer of 1945 four pharmaceutical companies began the commercial production of rutin from buckwheat based on our recommendations and advice. Approximately 12 pharmaceutical companies are planning to manufacture rutin during the 1946 season with an indicated production of from 10,000 to 20,000 pounds. This quantity is sufficient to treat 200,000 to 400,000 cases for a full year, thus making possible for the first time the extensive clinical and laboratory testing necessary for proof of the therapeutic value of rutin in various conditions. It was previously reported that rutin had been found in cooperative clinical tests to be of value in the treatment of capillary fragility associated with hypertension and other diseases. Based on a limited amount of clinical testing, it may have other important medicinal uses.

Because of the importance of making larger quantities of rutin available to meet the increasing demands from physicians for rutin for treatment of patients, and for further clinical evaluations, every assistance is being given to interested pharmaceutical companies in getting into production.



Clinical Testing - Rutin. Clinical testing of rutin is being carried out in cooperation with medical clinics, hospitals and physicians having adequate facilities for testing experimental drugs. Dr. J. Q. Griffith, Jr., of the University of Pennsylvania has treated a large number of patients with rutin, and the results show that rutin is almost 100% effective in decreasing capillary fragility associated with hypertension.

Dr. Griffith has also been studying the effect of rutin in the prevention of X-ray burns. Preliminary results indicate that in rats buffered with rutin the onset of X-ray burns is delayed, the burns are less severe and heal more rapidly than in non-buffered animals. Another physician has reported favorable results following the use of rutin in certain hemorrhagic conditions and functional bleeding, and Dr. Lorand Johnson of Western Reserve Medical School has indicated that rutin is effective in arresting the progress of diabetic retinitis.

Extraction Studies. Studies of the factors influencing the rutin content of buckwheat have shown that the maximum rutin content occurs at approximately the same physiological age (four blossom stage) regardless of the rate of growth. This has an important bearing on the question of the optimum date for harvesting the crop. Cooperative studies are underway to determine the effect of fertilizer treatment on the rutin content of several varieties of buckwheat. Special emphasis was laid on developing a method using dried buckwheat leaf meal, thereby permitting year-round operations not possible with fresh plants. Two comparatively simple methods, one using hot water and the other dilute alcohol, were developed.

Processing Vegetable Wastes for Animal Feeds. The proposed design of commercial driers for vegetable wastes was based upon experience in the pilot plant with a tray drier. In order to obtain more specific information on the performance of a continuous drier on this type of material, the tray drier was converted to a continuous drier of the same type previously recommended. Performance tests were superior to those using the tray drier and justify our earlier estimates of cost and performance. Operations during the 1945 season were devoted to producing approximately 1,000 pounds of broccoli leaf meal for chick feeding tests, studies on vitamin extraction, and for market development. Approximately 600 pounds of leaf meal were also prepared from lima bean vines for similar uses.

Recovery and Properties of Vegetable Leaf Proteins and Other Constituents.-Protoplasts. Digestion of vegetable leaves with the organism Clostridium roseum was found to produce leaf protoplasts rich in protein and lipoidal constituents and low in fiber and carbohydrate. Work on the amino acid composition of these protein concentrates is being actively pursued. The information so obtained will be of value in establishing the quality of leaf proteins for feeding purposes. Procedures are being developed for the recovery of carotene, tocopherol and chlorophyll from the lipid fractions.



Summary of Work on Vegetables. The commercial production of rutin from buckwheat, by methods developed by the laboratory, is under way and expanding. Assistance is being given and further processing improvements are being sought. Further clinical evidence has been obtained by the cooperator on the effectiveness of rutin as a therapeutic agent. Additional information has been obtained on the composition and nutritional components of vegetable wastes, likewise on processing of these wastes for feed.

#### Tobacco Utilization Investigations:

Current work on this project is centered principally on the following:

(1) Synthesis and testing of new fixed nicotine compounds as insecticides with special emphasis on problems involving the practical use of previously reported oil-soluble water-insoluble derivatives of nicotine. (2) Preparation and evaluation of quaternary nicotinium salts as fungicides. (3) Studies on the extraction and recovery of nicotine from green Nicotiana rustica. (4) Pyrolysis studies on nicotine.

Metal Nicotine Salts. A considerable number of metal nicotine salts and nicotinium salts have been subjected to laboratory and field tests for determination of their insecticidal or fungicidal efficacy. Testing was carried out in cooperation with the Bureau of Entomology and Plant Quarantine and various State Experiment Stations.

In field tests against the cotton aphid one of the compounds tested, zinc nicotine thiocyanate, was found to be approximately as effective as the nicotine mixtures and compounds used commercially. The Bureau of Entomology and Plant Quarantine is planning to conduct larger scale field tests. Orchard tests with cuprous nicotine thiocyanate against the codling moth have shown good insect control and negligible foliage injury. Laboratory nicotine compound 44 was used as a dust on poultry lice, and the preliminary tests indicate that it is more toxic than nicotine sulfate and is easier to apply.

Nicotinium Salts. Particular attention was directed to the study of methyl nicotinium salts and higher N-alkyl nicotinium iodides in view of the reported toxicity of methyl nicotinium iodide and dimethyl nicotinium diiodide to the melonworm, southern armyworm, and oriental fruit moth.

Laboratory tests by entomologists at the Connecticut Experiment Station have indicated that cetyl nicotinium bromide and cetyl nicotinium thiocyanate are toxic to red spider eggs. Of the nicotinium salts tested in a preliminary survey, benzyl nicotinium oleate was most effective against the nasturtium aphid while p-nitrobenzyl nicotinium thiocyanate was most toxic to the wireworm. Several nicotinium salts have given favorable results in control of apple scab and the large brown patch fungus in turf, although the duration of protectant action under field conditions was limited, presumably because of the high water solubility of the compounds.

These quaternary salts have also been tested as fungicides by plant pathologists at the Rhode Island Experiment Station. With the possible exception of methyl pyridinium iodide the methodides have been relatively ineffective as fungicides in preliminary laboratory tests. Fungicidal tests in 1945 with four nicotinium salts indicated poor toxicant retention on apple leaves under field conditions but this is understandable in view of the water-solubility (and surface activity) of the nicotinium salts and the unusually heavy rainfall. Attempts have now been made to enhance toxicant retention through formulation with numerous organic acids. Laboratory fungicidal evaluations of these formulations are now being made.

Nicotine-Dusts. Of 38 carriers studied as dust diluents for nicotine sulfate 12 were superior to the pyrophyllite standard against the melon-worm and southern armyworm. One carrier, a special type of fuller's earth, was unique not only in its effectiveness as a carrier for nicotine sulfate, but particularly in its ability to adsorb as much as 35% of an animal, vegetable, or mineral oil and still remain dustable. This high oil tolerance should be advantageous in the formulation of other oil-soluble insecticides, such as DDT. As a result of our studies this particular brand of fuller's earth, which was formerly used only as a catalyst carrier in hydrocarbon reactions, is now being sold in carload quantities for insecticidal use.

Pyrolytic Products of Nicotine. Laboratory studies on the preparation of various compounds obtained through pyrolysis of nicotine have been carried out with a view to obtaining substances of possible use as pharmaceuticals or for other applications. A number of these compounds have been prepared and submitted to outside laboratories for pharmacological testing.

Of especial interest for possible use as an adjunct in tobacco is the compound myosmine. This substance is a constituent of ordinary tobacco smoke, and presumably contributes to the flavor and aroma of the smoke. Results of tests carried out at the Laboratory were rather inconclusive as to whether or not treatment of tobacco with myosmine improved the quality of the smoke. In most cases tobacco treated with myosmine could be readily detected on smoking, but there was rather wide divergence of opinion among individuals as to whether or not the smoking qualities had been improved by such treatment. Considerable interest in myosmine for this purpose has been exhibited by the tobacco trade, and samples of tobacco so treated have been submitted to a number of tobacco companies for more complete evaluation by their testing panels.

In view of the increasing demands for nicotine, cooperative experiments are underway for the production of Nicotiana rustica for nicotine and to establish methods for the extraction of the alkaloid from the green, uncured plant as well as from dried material. These experiments are in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering.



Summary of Work on Tobacco. Studies have continued on the preparation and evaluation of nicotine products for their insecticidal or fungicidal efficacy. The properties and advantages of a colloidal clay as a nicotine carrier were established, resulting in the use of carload quantities for this purpose. Investigations have been made on the conversion of nicotine into compounds of potential value for pharmaceutical and other purposes.

#### Milk Products Utilization Investigations:

Current problems under investigation on this project include the following: (1) Studies on the development of methods for converting milk sugar through lactic acid into industrially valuable materials such as resins, synthetic rubbers, plastics, plasticizers, and related products. (2) Further studies on the development of a continuous method for production of casein bristle fiber for manufacture of brushes. (3) Pilot plant studies on the development of scrylic rubber (Lactoprene). (4) Investigations of the structure of protein fiber for use in textiles. (5) Studies of methods of modifying casein for use in preparation of improved casein plastics. (6) Basic studies of the composition and structure of milk proteins.

Casein Bristle Fiber. In view of the rapidly growing commercial interest in casein bristle, particular attention has been given to the development of a wholly continuous process of production. Considerable progress has been made, and it is now possible to carry the fiber much nearer to the finished product without resorting to batch handling. No major obstacle to a completely continuous production is now foreseen, and continuous manufacture may be expected to prove more economical and probably to yield a somewhat more uniform product. Bristles are being furnished to interested manufacturers for making experimental brushes, and a license has been issued to a commercial concern to operate under a pending patent. Another company has constructed and has in operation a factory for the commercial production of casein bristle for use in the manufacture of paint brushes.

Textile Fiber from Milk Proteins. Progress has been made on a number of phases of the problem of producing an improved textile fiber from milk casein. Results with high-temperature formaldehyde hardening indicates such a treatment may evolve into a satisfactory finishing treatment for casein fibers.

The Laboratory spinning machine has been modified so as to produce a twisted continuous filament yarn suitable for knitting. All previous fiber produced on this machine was not twisted and could be evaluated in yarn and fabric forms only after converting the fiber to staple and this in turn to staple fiber yarn. These operations required twenty pounds or more of staple since this is the minimum amount necessary to charge the smallest carding machine available to the Laboratory. The modification makes possible the investigation and evaluation of casein as a continuous filament. Its characteristics of high gloss and even dyeing should



constitute a practical advantage in comparison with acetate rayon, which requires special dyestuffs and often reveals uneven dye application.

Improved Plastics from Milk Proteins. Studies on the modification of casein by the introduction of higher fatty acid radicals with a view to lowering the water absorption capacity have been essentially completed. All of the substituted products evinced a lower water absorption, but introduction of the higher fatty acid residues was found to give materials superior to those containing the lower member acyl groups. This was particularly true in regard to flow, strength and brittleness.

Previous results obtained showed that beneficial effects are derived from incorporating organic plasticizer in casein molding powders. Means have now been found for incorporating both the plasticizer and formaldehyde without appreciable loss of either. Various formulations as to color and plasticizer can be readily obtained. In addition, the time required to prepare the molding powder from the base material (casein) is reduced to a minimum.

Resins, Plastics and Plasticizers from Lactic Acid. In previous work on the development of chemical derivatives of lactic acid (obtained through fermentation of lactose in whey) which might find useful application in the synthetic resins and plastics fields, a large number of compounds were prepared and their physical constants determined. A number of the more promising of these compounds are now being more completely evaluated for possible industrial use. For example, studies show that the monomeric alkoxyethyl ("Cellosolve") acrylates can be polymerized in organic solvents, giving solutions suitable for coating wood, metals, and other materials. The resulting films cure on heating in air and yield hard, glossy, flexible, almost colorless films that are insoluble in organic solvents, and show no tack up to 100° C. All the films adhere excellently to glass, metal, and wood. It has also been found that the acrylic and methacrylic esters of glycol and diglycol mono-ethers readily polymerize to produce soluble, clean, colorless thermoplastic resins which, on heating in the presence of air, are converted into thermoset resins that have excellent resistance to organic solvents.

Considerable interest has been shown by the Philadelphia Textile Institute and the Army Quartermaster Corps in the use of copolymer aqueous dispersion of capryl acrylate and ethyl acrylate as an impregnating coating for nylon fabrics. Pilot plant equipment is now being installed which will make possible the production of larger quantities of capryl acrylate for industrial evaluation and for obtaining chemical engineering data.

Synthetic Rubber from Lactic Acid. The study of acrylic elastomers rubber-like materials has been facilitated by the production of Lactoprene EV (95% ethyl acrylate-5% chloroethyl vinyl ether) on a pilot plant scale by one of the large rubber companies. The compounding and vulcanization of

Lactoprene EV have been studied intensively with great profit. Improved compounding techniques and recipes have been developed, satisfactory mold lubricants have been found, and vulcanizates having unusual resistance to heat aging have been prepared. Samples of 2 to 25 pounds of Lactoprene EV copolymer have been sent to more than ten industrial laboratories for study and evaluation.

Acrylic elastomers are inherently stable to aging even at elevated temperatures. Some of the vulcanizates of Lactoprene EV are apparently much superior in heat aging properties to all known elastomers except the Silicones. Even after being heated in the presence of air at 300° F. for 21 days, some of the vulcanizates retain their rubbery characteristics.

As shown by swelling data, Lactoprene EV vulcanizates are highly resistant to hydrocarbon oils. Comparative tests have indicated that Lactoprene is superior in this respect to natural and some synthetic rubbers. In addition to resistance to oils, Lactoprene has been found outstanding in stability at elevated temperatures, flex-life, and resistance to oxidation and cut-growth. It is anticipated that Lactoprene will find application in various special fields.

Summary of Work on Milk Products. Advances have been made in the economic production and quality of casein bristles. As an outcome of the Laboratory's work a full-scale factory is now starting operation for the production of casein bristle paint brushes. Progress has been made in the studies on the modification of casein and the production of textile fibers and plastics from these modified products. Numerous derivatives of lactic acid have been made for evaluation as plastics and rubber-like materials. These have been and are undergoing screening tests. A vast amount of physical and chemical data essential to the success of these investigations has been accumulated.

#### Animal Fats and Oils Utilization Investigations:

Current problems under investigation on this project include the following: (1) Studies on development of means for improvement of the stability and quality of lard. (2) Studies on the oxidation of fatty acids involving the development of procedures for the production of materials useful as plastics, dielectrics, plasticizers, emulsifiers, and lubricating oil modifiers. (3) Studies on the development of a satisfactory commercial process for production of high-purity oleic acid from animal fats, particularly tallows and greases.

#### Improved Emulsifiers for Use in the Manufacture of GRS Synthetic Rubber.

A sensitive and accurate spectrophotometric method has been developed in this Laboratory for determining the highly unsaturated fatty acid constituents in fats and soaps. By means of this method, and in cooperation with the Rubber Reserve Company and its collaborators, it was shown that the small amounts of highly unsaturated constituents of the soaps were responsible for considerable retardation of the polymerization reaction and that



mild selective hydrogenation of the fat was a remedy for the difficulty. New specifications for suitable soaps were accordingly adopted by the industry, requiring hydrogenation of stocks and rigid control of the highly unsaturated fatty acid constituents by spectrophotometric analysis. The new spectrophotometric method has been incorporated in the Rubber Reserve Company's Laboratory Manual, and will be used by the soap producers and by the rubber manufacturers as a means of testing the soaps. This method has been found to be superior to any chemical test or combination of chemical tests for this purpose.

Development of this spectrophotometric method of analysis and its application to soaps used as emulsifiers in the polymerization of GR-S synthetic rubber were important to the Government's synthetic rubber program. As a result of this collaborative study resulting in the adoption of soaps from hydrogenated tallows and greases as emulsifiers for use in the manufacture of GR-S synthetic rubber, the following advances or improvements have been made: (1) 100 million pounds annually of low grade tallows and greases will be utilized; (2) it is no longer necessary to use edible grades of tallow for the rubber program; (3) a 5-percent increase in production of GR-S rubber, using present plant facilities, was effected; (4) variable polymerization rates in the manufacture of GR-S have been eliminated, permitting a definite production schedule for the first time; (5) the sensitive spectrophotometric method of analysis developed has been found applicable to many other fat and soap problems, since the presence of even small amounts of polyunsaturated fatty acids may be of significance in other industrial, research, and food uses of animal fats. It has been reported that one large soap manufacturing company is already finding the method useful in preventing loss from oxidative deterioration in soaps.

Stability and Storage Investigations. Work is being continued on the synthesis of new compounds and their evaluation for use as antioxidants for fats. Preliminary results on the evaluation of the higher alkyl esters of gallic acid as antioxidants, not only for storage lard but also for certain baked products, are encouraging. For the first time the direct synthesis of these compounds has now been achieved with product yields of about 75%. The important problem of cost will therefore not present any obstacle to the ultimate commercial manufacture and use of these new antioxidants.

Work of a fundamental character on the mechanism of atmospheric oxidation of pure fat constituents is being carried out looking to a better understanding of fat deterioration. The rate of oxygen absorption and peroxide formation on various components and derivatives of fats and oils have been determined 100° C. Antioxidants such as propyl gallate were effective in preventing or delaying the onset of oxidation. The results of the oxidation of pure fat constituents is providing fundamental information on the probable course and mechanism of the oxidation. The results also show the importance of the use of antioxidants even for the saturated fatty acids such as stearic acid. This information is of direct interest to soap manufacturers and those engaged in manufacture of commercial stearic acid.



Lubricating Oil Additives from Fats. Arylstearic acids made by combining oleic acid with an aromatic compound have been found to have valuable properties, in the form of simple derivatives, as addition agents to lubricating oils. At the request of the Naval Research Laboratory a large number of arylstearic acids have been prepared for their tests. The Naval Research Laboratory has found these compounds to have valuable properties as corrosion inhibitors. The usefulness of these compounds has been verified in large-scale tests. The program underway at present includes work on further improvements in the synthesis, the preparation of new arylstearic acids, and the preparation of compounds related to the arylstearic acids.

Basic Composition Studies. Work has been initiated on the fractionation of lard and tallow by systematic crystallization from solvents. The procedure developed for the fractionation of fats is serving as a useful means for preparation of substantial amounts of certain glyceride fractions, consisting principally of a single type or class, e.g., trisaturated, or disaturated glycerides, for special investigations such as a study of their physical properties in relation to plastic range, shortening and creaming power, and consistency. The fractionation procedure is also proving useful in following changes in glyceride composition during hydrogenation. The data from these laboratory-scale separations should also serve as a background from which processes may be developed for manufacturing industrially important fats for specialized uses.

Summary of Work on Animal Fats and Oils. The Laboratory's development of an accurate spectrophotometric method for determination of highly unsaturated fatty acids in fats and soaps has resulted in many improvements in the making of synthetic rubber. Encouraging results have been obtained in the development and evaluation of new antioxidants for lard. Fundamental data have been obtained which should be of great value in the solution of the difficult problem of stabilization of fats. Numerous derivatives of oleic acid, a constituent of lard, have been prepared for use as additives to lubricating oils and their usefulness established in large scale tests.

#### Potato Utilization Investigations:

Current problems under investigation on this project include the following: (1) Studies on the technology of potato starch manufacture with a view to improvement in quality and yield of the starch manufactured in existing factories and development of methods for treatment and disposal of potato starch factory wastes. (2) Investigations on the basic physical properties of potato starch with a view to new or extended applications based on any unique properties possessed by potato starch. (3) Studies on the development of allyl starch for use in the protective coating, plastic, and laminating materials fields. (4) Pilot plant studies on the preparation of allyl starch. (5) Effect of various conditions of potato storage on the yield and quality of starch obtained.

Storage and Quality Studies. Work on storage of potatoes under controlled

conditions of temperature to determine the effect of storage conditions on the starch content of the potatoes and yield of starch in the factory has been undertaken in cooperation with the Maine Agricultural Experiment Station. These studies were carried out at the Aroostook Farm of the Maine Station, using two of the most common Maine varieties stored at controlled temperatures varying from 34° to 60° F. Samples were removed from each of the storage bins at about seven-week intervals, and complete analyses of the samples made to determine the changes taking place. While the tests have not been completed, a number of significant physical and chemical changes have been noted. The most important chemical changes from the standpoint of utilization of potatoes for industrial or food uses are those in starch and sugar contents. After seven weeks' storage there was a large increase in both total and reducing sugar contents in potatoes stored between 34° and 38° F. At higher temperatures the changes were insignificant. Parallel with the rise in sugar values at lower temperatures there was a falling off in starch content. These values were obtained on potatoes immediately after withdrawal from storage. If the potatoes are permitted to remain at room temperature for two weeks or longer after withdrawal from storage, the sugars disappear gradually and the starch content increases, approaching the original value of the starch on a percentage basis. Somewhat different results are obtained if the potatoes after withdrawal from storage are kept at elevated temperatures (95° F.). In this case the starch content continued to decrease while the content of sugars gradually increased. From the standpoint of starch production these results would indicate that low yields of starch would be obtained if potatoes withdrawn from cold storage are processed at once. It would be equally undesirable to process them at once for dehydration purposes or for making potato chips, because potatoes with high reducing sugar content yield off-color products.

Processing Surplus Potatoes in Beet Sugar Plants. In connection with the acute surplus of potatoes that occurred during the 1945 season, it was suggested that beet sugar factories might be quickly modified to convert surplus white potatoes into a grade of starch from which glucose sirup suitable for food uses could be made. This would be of doubtful economic feasibility under normal conditions but was investigated in view of the surplus of potatoes and the shortage of sugar. It was impossible in the short time available and with the limited equipment on hand to definitely establish the feasibility of this plan. However, pilot plant data were accumulated which indicated the probability that with the addition of hammermills, vibrating screens, and a few accessories, a beet sugar factory would be able to produce potato starch of a purity adequate for making edible glucose sirup. The starch recovery would be about 75 percent of that contained in the potatoes. In connection with these studies some attention was given to stream contamination by effluent waters from such operations.

Preparation and Evaluation of Alkyl Starch. In connection with the



development of allyl starch for use in plastics, as a laminating agent, and in the protective coating field, further improvements in the laboratory method of preparation have been made. Although suitable pilot plant equipment for preparing allyl starch has been designed and ordered, so far delivery has been held up because of the general shortage of materials.

Considerable further progress has been made on evaluation of allyl starch, particularly for use as a lacquer material. Allyl starch is a high polymeric lacquer material which is capable of drying, free from tack, by evaporation of solvent. In addition it hardens by oxidation to form a coating which is highly resistant to attack by organic solvents. This exhibition of maximum solvent resistance is achieved mainly by baking the coating at temperatures of from 100° to 200° C. for various periods of time. Similarly, reasonable solvent resistance may be acquired merely by air drying for approximately one week at room temperature, provided oxidation catalysts in the form of paint driers are employed. Recently the evaluation of allyl starch coating has been directed principally at determining the potential usefulness of the material as an air-drying coating suitable for furniture finishing. Heat-reactive protective coating materials are restricted in their usefulness to an industry where adequate curing equipment is available. Another large field of use for air-drying coating materials for application to wood surfaces is by the householder, the independent painter, and the furniture manufacturer. Here the use of drying temperatures in excess of 60° C. is not recommended because of the danger of upsetting the dimensional stability of the wood. A number of types of resins and plasticizers are being studied as possible modifiers in air-drying allyl starch coating. The following formulation has been found to be suitable for an interior wood finish: Allyl starch, 100; a non-drying alkyd type resin, 30; xylene, 370; Butyl Cellosolve, 37. Cobalt drier (.075 percent cobalt on basis of non-volatile content) is normally added to accelerate drying. This formulation has been used on wood furniture with promising results. The working, drying, and hardening properties approximate those of the best commercial furniture finishes.

Summary of Work on Potatoes. Significant physical and chemical data have been collected on the changes occurring in potatoes during storage - information of value in the processing of potatoes for starch. Engineering data were collected relative to the type, size, etc., of additional equipment necessary for beet sugar factories to process surplus potatoes for starch of suitable quality for conversion to edible glucose sirups. Definite progress has been made in improving the yield, formulation and evaluation of allyl starch for protective coatings and similar purposes.

#### Tanning Materials, Hides, Skins, and Leather Investigations:

The current research program on this project includes the following: (1) Development of scrub oak bark for production of tannin, including studies of methods of bark recovery, large scale extraction of the tannin by



commercial extract manufacturers, and subsequent large scale tanning tests by commercial tanners. (2) Development of canaigre as a source of tannin, and utilization of co-products such as starch. (3) Studies on domestic sumac as a source of tannin for tanning light leather, and modification of character of sumac extract for adaptation to heavy leather tanning. (4) Preliminary studies of various new materials as potential sources of vegetable tannins. (5) Studies of methods of curing, conserving, and preservation of hides and skins. (6) Studies on development of more effective mold-resistant treatments for leather with special reference to their application to leather goods for both civilian and military use in humid and tropical climates.

Canaigre. An efficient process has been developed for extracting tannin from canaigre in the presence of starch. Canaigre liquors have been fermented and concentrated to good quality, high purity tanning extracts, and pilot plant extraction studies will be carried out to determine the feasibility of the process from an engineering standpoint. Progress on the development and utilization of canaigre as an additional source of tannin is of particular importance in view of the present and anticipated future shortages of domestic tannins.

Scrub Oak. Work is being continued on the development of scrub oak bark as a source of tannin. Scrub oak logs are too small to justify hand-peeling, and it is proposed to chip the logs and branches, then make a mechanical separation of bark from wood. Our Florida cooperator--the Engineering and Industrial Experiment Station of the University of Florida--has made available and is using a portable hog for cutting the logs and branches. The preparation of approximately 200 tons of bark for extract preparation will be carried out just as soon as an acceptable means of bark preparation and separation has been worked out. Tentative arrangements have been made with an extract manufacturer for manufacture of the extract from the 200 tons of bark as soon as it is available, and with a tanner for commercial evaluation of the extract.

Sumac. Progress has been made in the selection and development of high tannin strains of sumac suitable for use in propagation. These plants have been under cultivation for several years and have been shown to be strains that produce leaves high in tannin. Comparison of the tanning properties of Sicilian and three varieties of domestic sumac obtained through commercial tanning tests showed that a domestic sumac--Rhus copallina-- in the opinion of experienced tanners produced the best leather and Sicilian sumac next best. Heretofore it generally has been considered that domestic sumacs were inferior to Sicilian for tanning.

Prevention of Leather Deterioration. Although the mold resistant treatment for leather developed by the Eastern Regional Research Laboratory, in which the active ingredient is salicyl anilide, gives highly effective protection, and has been adopted as Army Tentative Specification AXS-1416,

in a few cases some mold growth has been noted, and there is some tendency of the leather to "bloom" when exposed under highly humid conditions. These results probably explain the few instances where complete protection was not obtained. The undesirable features and difficulties of application experienced with compound AXS-1416 have been overcome in modified and new mixtures that have been tested in the laboratory with highly successful results. These treatments are now under extensive field tests in the tropics. Dinitro ortho cresol, one of the most promising fungicides studied, is being subjected to patch tests to ascertain its dermatitic reactions. If these treatments prove effective in field tests and show no toxic effects they will deserve consideration for official adoption.

Alum Retannage of Leather. The War Department has set up a comprehensive program of research to secure fundamental information on leather and to aid in attaining military leathers of the highest possible serviceability. The research on alum retanning of vegetable-tanned leather is of significance to the War Department's leather research program, part of which involves the development of better insole leathers.

Preliminary small-scale tanning tests have been made in which the use of the customary alum retanning liquor has been compared with that of liquors modified by the addition of a "masking" agent such as acetate and tartrate salts. There was no change in area of the leathers tanned in the "masked" liquors after boiling one minute in water, but the regularly tanned leather under the same test shrank to about one-half its original area. These results are promising since they point to the possibility of producing a leather for use as insoles that will be area stable and resistant to moist heat.

Conservation of Hides and Skins. Studies have been continued with a view to developing improved methods for curing and preserving hides and skins. In connection with investigations on the effect of concentrated salt solutions on hides when used for curing, a technique for detecting damage to the hide has been worked out based on use of the electron microscope. With this technique it is possible to detect various degrees of damage by observing the condition of the leather fibrils under high magnification. This method should be very useful in following the effect of various curing treatments on the hide.

The bacteria that attack hide or skin during curing and storage may be either aerobic or anaerobic. The former grow only in the presence of oxygen, the latter when oxygen is absent. A comparative study of salt curing of calfskin under aerobic and anaerobic conditions showed that there was a much greater loss of hide substance during aerobic than during anaerobic curing. Evidence was found also that stains may form on skins, especially at points where blood is present, if the skins are stored under aerobic conditions subsequent to anaerobic curing.

Summary of Work on Tanning Materials, Hides, Skins, and Leather. In the

long term cooperative program previously set up for the development of canaigre as a domestic source of tannin, progress has been made in obtaining data on yields from different areas and plantings; and the separation of the tannin from the starch--this separation process now being ready for pilot plant evaluation. Advances have likewise been made in investigating scrub oak and sumac as likely domestic sources of tannin materials.

The mold resistant treatment for leather, developed by the Laboratory and adopted as an Army Tentative Specification, has been modified and made still more effective in laboratory applications.

Advances have been made in the study on the alum retannage of vegetable tanned leather in cooperation with the War Department.

In studies on the curing and preservation of hides and skins, it was found that there was much greater loss of hide substance during aerobic than anaerobic curing, a finding which should lead to better curing methods and consequent conservation of raw materials.

### Northern Regional Research Laboratory

#### PROJECT STATEMENT

Project	1946	1947 (estimated)	1948 (estimated)
1. Agricultural residues utilization investigations.....	227,493	275,300	278,900
2. Corn, wheat, and other cereal crops utilization investigations a/.....	614,908	646,265	654,700
3. Soybeans and other oilseed crop utilization investigations .....	227,635	275,300	278,900
Unobligated balance .....	21,999	- - -	- - -
Total available .....	1,092,035	1,196,865	1,212,500
Anticipated supplemental .....	- - -	-113,500	- - -
Total appropriation or estimate ..	1,092,035	1,083,365	1,212,500

a/ - Joint project with Western Regional Research Laboratory.

#### Examples of Progress and Current Program:

##### Agricultural Residues Utilization Investigations:

Research on agricultural residues is national in its scope. Its aim is to find the most profitable uses for agricultural residues either on the farm or in industry. Three main principles are used to guide the research



and development work: (1) Exploration of the physical and chemical properties of specific residues to determine wherein they may render a service in industrial or farm use not so readily supplied by other raw materials; (2) development of processes involving their use wherein a money value can be obtained from each of their three major constituents--cellulose, hemicellulose, and lignin; and (3) cooperation with other agencies to improve the over-all economics in collection, transportation, and storage of these raw materials. The development work falls naturally into five group classifications: (1) Cellulose pulps for the manufacture of paper, (2) building materials, (3) plastics, (4) industrial chemicals, and (5) miscellaneous uses.

Cellulose pulps for the manufacture of paper - 9-point corrugating straw board. Twenty-eight mills, for the most part located in the Middle West, annually use about 750,000 tons of cereal straws, principally wheat, for the manufacture of about 550,000 tons of corrugating straw board used for shipping containers. The technical men and executives of the straw board industry have met at the Northern Laboratory, are pooling their interests in technical matters, and, under the guidance of the Laboratory, are changing their viewpoint towards farmer relationship in the procurement of straw. One of the serious problems facing this industry has been the lack of development of suitable pick-up balers for operation in conjunction with the combine harvester. While this situation was remedied somewhat by development work on the part of the farm implement industry just prior to the war, there has been a shortage of baling equipment. Definite steps have been taken to discuss collectively these problems and to arrive at a satisfactory and practical industrial answer.

This Laboratory has developed and has ready for pilot-plant studies an improved process for manufacturing 9-point corrugated straw board. The product will have an increased tear resistance of about 50 percent. The board will be bulkier which should result in a better financial return for the product. Due to the freer drainage characteristics of the pulp it should be possible to produce more paper on a paper machine in a given period of time. One large mill is at present attempting to assemble the necessary machines to carry on a pilot-plant and full-scale study of this process.

Fine papers from cereal straws. Agricultural residues have not been used in recent years in the United States for the manufacture of types of paper other than straw board and cigarette paper. The economics of pulp wood has been so favorable that the paper industry has concentrated entirely on the use of papers manufactured from wood. There is ample practical experience in other parts of the world, however, that fine papers can be manufactured from agricultural residues, particularly from cereal straws.

Within the last year there has been a profound change in the relative cost positions of wood and agricultural residues, which is expected to

affect the choice of raw materials used by the paper industry. The cost of pulp wood in the United States has increased enormously in price during the past 5 or 6 years, in many cases doubling in price. Many paper mill engineers feel that pulp wood prices will not decline appreciably in the future. Only a small improvement in collection and handling will place agricultural residues in the position where they would be seriously considered as a raw material for manufacturing certain types of specialty papers.

Work at the Northern Laboratory has consisted in an exhaustive study of the application of the various methods used for producing wood pulp to the pulping of agricultural residues. These studies have led to what, in preliminary form, appears to be an outstanding advance over European practice in producing pulps from straw.

Building materials. The Northern Regional Research Laboratory has completed its work on the development of a rural industrial process for the manufacture of insulating building board from straw. Two bulletins covering this development are in process of publication. This study was taken up to find what problems would be encountered in developing the process on a cooperative rural scale. Capital investment, including operating capital, is estimated at \$50,000. The success of the operation will be dependent on such factors as location of the plant, competition, labor costs, and business management. This process may be of very considerable value to islands, such as the Philippines, and perhaps in China.

It has long been known that agricultural residues can be used for the manufacture of insulating building materials. Much insulating building material is produced from wood fiber. Such products are quite acceptable in the trade, but are not as rugged and do not have the resistance to breaking as the products which are manufactured from long fibers derived from sugarcane bagasse, cornstalks, or straw. This Laboratory is carrying on an extended study to demonstrate that agricultural residue fibers can be used to improve the characteristics of boards now manufactured from wood. The tremendous demand for building materials makes it desirable to have the public much more fully informed of the methods of manufacture and resources available for such manufacture. The Northern Laboratory has developed two types of products for which manufacture is being considered. One is a board produced either from wheat or rice straw. The other product is a panel-type board manufactured by somewhat the same technique but which is resistant to shock and which has been found to have superior qualities for use as a shotgun wad.

Plastics. The Northern Laboratory has completed its work on the use of ground agricultural residues as a filler in phenolic plastics. It has been shown that when proper modifications have been made in the resinous components, agricultural residues may replace wood flour very satisfactorily. Corn cob and rice hull flours are particularly suitable for such use.

As further development a molding powder has been developed which contains 50 percent ground agricultural residues, 25 percent phenol-formaldehyde, and 22.5 percent inorganic fillers. The plastic made from this molding powder has the strength properties of general-purpose phenolics which use a much higher percent (47) of resin, and because of the smaller quantity of resin necessary, the cost of manufacture should be about 25 percent lower.

A study is also being made of the use in plastics of lignin produced in the synthetic liquid fuel-saccharification process (another development of this Laboratory), from materials such as corncobs, bagasse, and the like. Methods have been found for utilizing lignin as a filler in the production of plastics which are tougher and stronger than those heretofore made.

Miscellaneous uses--Noreseal, a cork substitute. Pilot-plant studies on the manufacture of Noreseal have been completed. A method of dispensing Noreseal directly into crown caps has proved to be practical. The process is almost automatic in operation, thereby reducing labor costs. Seventy thousand crowns prepared by the dispensing method are now in the hands of the bottling industry undergoing final field tests. A manufacturer of crown cork seals has built one unit of an industrial plant to manufacture Noreseal by the dispensing method and is prepared to undertake experimental manufacture as soon as the field tests are completed.

Soft-grit blasting materials. As a result of the suggestion by the Northern Regional Research Laboratory the use of a mixture of 60 percent ground corncobs and 40 percent whole rice hulls was adopted by the Navy during the war as a soft-grit blasting material for cleaning airplane engines. Following demonstration work by the Laboratory which showed that this method was exceedingly effective in cleaning automobile parts and other engine and machine parts of scale, rust, grease, and carbon, industry has taken up the method and soft-grit blasting materials of this character are beginning to move into the market. As examples of uses for the material several of the large companies rebuilding automobiles have adopted the use of corncob-rice hulls soft-grits in line operations in cleaning carburetors, fuel and water pumps, and pistons. One company solved the problem of cleaning aluminum foundry cores by this method. A number of glass companies are using the method for cleaning their molds. A large oil company is using this method for removing paint from the roofs of gasoline storage tanks since the material does not produce sparks.

Summary of the Work on Agricultural Residues. The Laboratory's efforts have resulted in industry using a mixture of corncobs and rice hulls, and other agricultural residues as soft-grit blasting materials for cleaning metals. This is an extension of the uses for ground corncobs.

During the coming year industrial trial of the following processes will be



undertaken: Rural process for the manufacture of insulating building board from straw; large-scale manufacture of low density insulating-type boards from wheat or rice straws; Noreseal, a cork substitute, for use in the bottling industry; an improved process for the manufacture of 9-point corrugating strawboard; and the use of cellulose pulp from wheat straw as a liner in solid container board.

Work will be concentrated during the coming year on the following problems: A process for producing bleached cellulose pulp for use in specialty and fine papers in high yields from wheat, rye, and rice straws; a fundamental study of the principles involved in the manufacture of such building materials as insulating and hard board; the use of nut shells and fruit pits for soft-grit blasting and as fillers in plastics; the use of lignin in plastics and materials of construction; and further development of chemical intermediates derivable from furfural or xylose.

In cooperation with the Synthetic Liquid Fuels Project the Northern Laboratory plans to conduct fermentations in the alcohol pilot plant, half of which will deal with the conversion of xylose to butanol, acetone, and alcohol and half with the conversion of glucose to ethyl alcohol. Complete operating and cost data will be obtained. Studies will be conducted on the crystallization of corn sugar from glucose solution and on the pharmacological action of xylose. Cooperative studies are planned with the Bureau of Plant Industry, Soils and Agricultural Engineering on the use of lignin as a soil conditioning agent and on improvements in the methods of collecting and storing agricultural residues.

#### Corn, Wheat and Other Cereal Crops Utilization Investigations:

Typical problems on which research on grains is being actively pursued are: (1) The relationship between the chemical composition and the breeding of grains; (2) the development of cheaper processes for the production of motor fuel from starchy crops; (3) the testing and evaluation by actual engine performance of agricultural motor fuels; (4) the development of improved methods for producing starch and sirups from grains; (5) the utilization of starch corn sugar, and protein for the production of new chemical industrial raw materials; (6) the development of adhesives, plastics, and fibers from starch and protein; and (7) the development of new fermentation procedures for converting grains to chemicals, drugs, or food products.

Chemical composition and breeding of corn. For industrial utilization the amounts of starch, oil, and protein in corn are of paramount importance. Of almost equal importance is the distribution of these constituents among the components of the corn kernel--the endosperm, germ, and bran. None of these factors have been considered in breeding today's commercial hybrid corn which now is used, for example, on more than 95 percent of the corn acreage of Iowa and Illinois.

Recent progress of the determination of the relationship between chemical composition and the breeding of corn may be summarized briefly as follows: (1) Chemical analysis of 145 single-cross hybrids has permitted the

evaluation of about 20 inbred lines of corn for transmission to their progeny of specific chemical properties; (2) analysis of 170 samples from farmers' fields have checked with these evaluations; (3) by hand-separation of the constituent parts of kernels and analysis of these parts, it was shown that high-oil content corn has a proportionately higher oil content in the germ (thus making any increase in oil content available through processing); (4) analysis of the inbred lines rather than of the single crosses will apparently give the same data and permit faster progress on this problem; and (5) the results of this work clearly indicate that a close relationship exists between the composition of hybrid corn and its percentage. This will permit corn breeders to screen out undesirable parent stock and will facilitate their search for new strains of corn superior for food, feed, and industrial purposes.

Agricultural motor fuels. The requirements for industrial alcohol during wartime were increased more than five times over normal peacetime production levels, mainly to satisfy the synthetic rubber program. About 400 million gallons per year or 65 percent of the total production--was produced by fermentation of cereal grains. This production resulted in an unprecedented heavy demand for malt and a severe malt shortage was expected. Work was therefore initiated on the development of mold products as substitutes for barley malt. This work resulted in the development of improved methods of production of "mold bran" as an agent for converting the starch in grain to sugars. When the war ended, the emphasis of the program was shifted to the development of a cheaper process for the production of power alcohol.

A nutrient medium was developed and the best conditions for growing the mold were determined. Laboratory work on the A.niger strain was then translated to a pilot-plant scale. With this new mold product, the yield of alcohol obtained was 5.15 proof gallons per bushel as compared to 5.1 proof gallons obtained in control fermentations, which were identical except for the substitution of barley malt for the mold product. Not only does the use of the mold product give as much or more alcohol than barley malt, but estimates show that the use of the mold product will lead to a substantial reduction in the cost of producing alcohol.

Testing of agricultural motor fuel. Before motor fuels from agricultural products can be used widely and successfully, information on their properties and performance must be available. Recent progress includes: (1) Injection of alcohol-water in an automobile engine was found to give increased torque and brake mean effective pressure; (2) evidence obtained thus far shows that alcohol or alcohol-gasoline blends are not any more corrosive than gasoline; (3) blends of various agricultural motor fuels were tested for gum stability; (4) data have been obtained on the increase in indicated horsepower output of alcohol-gasoline blends at increasing compression ratios; (5) studies on the combustion and pre-ignition behavior of motor fuels have been started.

Syrup production from starchy crops. The shortage of sugar, which develop-



ed during the war and which still persists, resulted in an enlarged industrial program of syrup production. This crisis was intensified in the latter part of 1945, when supplies of grain for the production of alcohol were reduced drastically and placed on a quota basis. Many large distilleries anticipated the necessity of closing some plants or of converting them to other operations. As the Northern Regional Research Laboratory has developed the largest body of accessible data in this country on the production of starch and syrups from grains, many requests were received for information concerning the utilization of distillery and existing equipment for the manufacture of syrup from corn, wheat, and wheat flour.

The results of the work on the conversion of granular wheat flour to maltose syrup were furnished several companies, and enabled them to change from the production of alcohol to the manufacture of maltose syrup from grain. This development not only aided in alleviating the syrup shortage, but also provided industries with a means of retaining employees on the job.

Batter process for production of starch and gluten from wheat flour. Detailed information on the development of the "Batter Process" for the separation of starch and gluten from wheat flour was reported in 1944. Since that time, because of the extremely low supply of sweetening agents, interest in the process by commercial firms has increased tremendously.

Because of the probable continued interest of farm cooperatives in the production of syrup from wheat, consideration was given to the cost of installation and operation of the batter process in altered beet sugar factories to produce glucose syrup from flour.

Ever since the batter process was developed, the Northern Regional Research Laboratory has recommended and urged the operation of the process during the off-season at suitably located beet sugar refineries. There are several advantages in favor of such a staggered operation. The company which originally translated the batter process to an industrial scale in a beet sugar factory acquired another unit in the late summer of 1945.

In this latter factory, the batter process was installed for the first time as an adjunct to the normal operations of a refinery. Beet sugar will be produced during the sugar-beet season and wheat syrup during the remainder of the year.

Within the past year, a large eastern cane sugar refinery initiated operations on the production of wheat syrup. Complete details on the batter process were furnished this company and specific recommendations made on the installation of the process in the refinery. The production of wheat syrup in this refinery alone is expected to reach 75 million pounds annually.

The industrial concern which utilized the batter process during the war for the production of alcohol and wheat gluten, is now converting the



starch to maltose syrup. This company is now planning to construct, in 1947, a \$2,000,000 plant in Missouri for the production of wheat gluten and glucose syrup.

Early in 1946, before the development of the critical shortage of wheat occurred, the estimated annual production capacity of manufacturers using the batter process was as follows:

24,000,000 pounds of dextrose  
123,000,000 pounds of syrup  
32,000,000 pounds of gluten  
7,000,000 pounds of alcohol

This production required as raw material a total of 250 million pounds of wheat flour per year. The grades of flour most widely used were first or second "clears" which in normal times are a drug on the market.

Wheat gluten. Wheat gluten is now being produced commercially on a large scale by the batter process which was developed at the Northern Regional Research Laboratory. The methods in use for recovering and drying the gluten result in the production of a devitalized material which is suitable only for feed or for use in the manufacture of monosodium glutamate. The development of a drying method for producing gluten, leaving it in possession of its original gumming characteristics and at a cost of approximately 10 cents per pound, would have many more uses. Possible uses for undeveloped wheat gluten include the fortification of wheat flours which are low in protein content and the manufacture of packaged bakery products in which uniform quality and size of the product are of paramount importance. It also has possibilities as an egg yolk substitute in cake making and as a meat extender.

Work is now being conducted toward developing a cheap, continuous process for drying wheat gluten without devitalizing it. Experimental runs have been conducted on a semi-pilot-plant scale with use of equipment designed and built at this Laboratory. The product can be made into a dough having a strength equal to or greater than that of commercial gum gluters.

Synthetic textile fibers from corn. Synthetic textile fibers have been prepared from a corn gluten fraction on a laboratory scale. The process developed is a continuous one and involves solution of the gluten in caustic, aging the solution, pumping it through spinnerettes, and coagulating the strands. The fiber is strong and resilient and its dry strength closely approximates that of wool. Wet strengths of the fiber are superior to all commercial synthetic fibers made from protein. Cleaning the fibers by washing with soap solutions does not impair their strength. One company is planning to produce the fiber on a pilot-plant scale. Further studies on the preparation of the fibers, on the continuous processing of the fibers in larger quantities, and on the preparation of yarn and cloth are planned for the coming year.

Saccharic acid from dextrose. A procedure has been developed for producing saccharic acid in nearly 50 percent yield and oxalic acid in about 40 percent yield from dextrose sugar. Saccharic acid shows promise of being a valuable addition to the food acid field. Of particular importance should be its use in baking powders, confectionery, carbonated beverages, and pharmaceuticals. It is also an attractive industrial raw material, being closely related to one of the products utilized in the production of nylon. Patent applications have been filed for this process and also for a method of converting potassium acid saccharate into calcium saccharate.

Levoglucosan from starch. Levoglucosan has been prepared in good yield by the destructive distillation of starch. Careful investigation of all the factors affecting the process led to a method whereby 0.4 to 0.5 pound of levoglucosan is obtained from 1 pound of starch. This substance previously has been only of theoretical interest, because no economic method for its preparation had been developed. A number of industrial firms and research organizations have expressed interest in our method of preparation. Upon request samples were sent to Edgewood Arsenal for evaluation of its suitability for the production of stable demolition-type explosives.

Penicillin. Work on the penicillin program at the Northern Regional Research Laboratory was discontinued November 1, 1945. This work was terminated because all major production problems had been solved. The importance and size of the industry, as well as the role played by the Northern Regional Research Laboratory in this development, are now common knowledge. During the last 6 months the penicillin program was underway the optimum conditions for producing penicillin X in maximum quantity were developed. This type of penicillin gives more satisfactory results than other penicillins in the treatment of certain diseases. A research program on the production of new types of mold and bacterial antibiotics has been initiated. In particular, a search is being made for those which would be useful in the treatment of tuberculosis and undulant fever.

Hybrid corn tassels. Hybrid corn tassels have been found to be of value as a feed. Tassels equivalent to 50,000 tons of dried material are annually discarded. Recovery of these tassels would provide additional feed to supplement our current short supplies.

Tassels of various stages of maturity were analyzed for contents of protein, fat, ash, crude fiber, and vitamins. It was found that the vitamin and protein content of tassels are unusually high when compared to other structural parts of the corn plant. The tassel contains more crude fiber than does corn, but the content of crude fiber is no greater than that in good leafy alfalfa hay. On the whole, the analytical data indicate that dried tassels are superior to corn and other cereal grains, although inferior to such other feed concentrates as distillers' solubles or dried milk.



Mold yeast and bacteria culture collection. The maintenance and study of a large and varied collection of microorganisms including molds, yeasts, and bacteria is essential to the proper prosecution of a well-rounded program of fermentation research. The examination of inadequately studied species constitutes the best means of finding new fermentation products of possible industrial significance.

Through studies made possible by this Laboratory's culture collection, improved citric acid-producing molds have been demonstrated, special yeast strains for alcohol production were found and made available to producers of alcohol for the wartime rubber program, increased itaconic acid yields have been obtained and penicillin-producing molds capable of application in vat fermentation processes have been found and supplied to industry. A mold culture found especially useful in cheapening the cost of production of alcohol by reducing malt requirements is *Aspergillus niger* NRRL 337, which was obtained from Berlin in 1923 and has been kept in continuous laboratory culture since that time.

The Collection currently contains in excess of 4,000 cultures including more than 2,000 molds, about 600 bacteria and approximately 1,400 yeasts. A continued effort will be made to enhance the value and usefulness of the Culture Collections.

Summary of the Work on Corn, Wheat and Other Cereal Crops: Significant advances have been made in the past year on the development of new and extended uses for corn, wheat, and other cereal grains. Chemical composition and the heredity of corn have been shown to be closely interrelated. This finding will permit hybrid corn seed processors to screen out undesirable parents and facilitate the search for strains of corn superior for food, feed, and industrial purposes. A new method has been developed for cheapening the cost of production of alcohol as an agricultural motor fuel; more costly barley malt can readily be replaced as a new type of mold product. Engine performance tests have shown that alcohol is an excellent motor fuel. Pilot-plant work on the production of maltose sirup from wheat flour was completed. Technical information gained on the solution of this problem enabled several distilleries to smoothly convert their distillery operations to the production of sweetening agents. The new industry which was established for the production of sirup from wheat flour by means of the Northern Regional Research Laboratory better process has continued to expand. Two hundred and fifty million pounds of wheat flour are now being converted annually through the better process for the production of glucose and gluten. Operation of this process as an adjunct to the production of sugar by beet-sugar factories shows promise of revolutionizing the beet sugar industry. Methods for the conversion of corn protein to synthetic textile fibers approximating wool in strength have been developed. Hybrid corn tassels, 50,000 tons of which are discarded annually by commercial corn breeders, were found to be a good animal feed. Organic wastes resulting from the production of penicillin and amounting to 12,000 tons have been shown to



be an excellent chick feed. Just prior to discontinuance of the penicillin program, optimum conditions were discovered for producing in maximum yield penicillin X which is preferred to other penicillins for the treatment of certain diseases.

#### Soybean and Other Oilseed Crops Utilization Investigations:

Concomitant with the increase in soybean production has been the establishment of the large soybean oil processing industry. Utilization of the products of the soybean in the food, feed, and industrial fields is now of major significance.

With the aim of increasing the demand for soybeans and other oilseeds, the program of research has been directed toward (1) the development of new, or the improvement of known, methods for separating the oil from the seed; (2) the elimination of the flavor instability of soybean oil; (3) the improvement of flavor and color of soybean meal so as to produce a more acceptable food product; (4) the development of new industrial raw materials, resins, adhesives, and lubricants from the soybean; and (5) the modification of soybean oil to increase its utilization in the paint and varnish field.

Alcoholic extraction of soybeans. Two processes are being utilized industrially to separate the oil from soybeans; one involves the use of heat and pressure and the other extraction by means of petroleum solvents. The meal produced by these two processes, in general, is colored and unpalatable. Because it was known that alcoholic extraction of soybeans leads to a palatable meal, a program was initiated to develop an economically feasible method of separating the oil by means of alcohol. Such a method, for operation on a continuous basis, has now been developed and perfected. Experimental work has demonstrated that food products such as bread, meringues, whips, and candies containing this alcohol-extracted soybean flour are superior in flavor and color, and are equal nutritionally, to similar products prepared from commercial soybean flour. Protein derived from alcohol-extracted flour and useful in fiber production and paper coatings is whiter than the analogous product prepared through extraction of the beans with petroleum solvents.

The alcohol-extraction process has been translated to a pilot-plant scale, in order to obtain data necessary for engineering design. Operation of a plant utilizing this process is expected to lead to (1) lower costs of extraction, (2) increased yields of a higher-quality oil, and (3) the production of a palatable soybean flour. Of added significance to agriculture is the use of a solvent derived from farm products rather than petroleum.

Flavor stability of soybean oil. One factor which will continue to limit the use of soybean oil for edible purposes is the flavor instability of soybean oil and various products made from it such as salad oils, margarine, and shortening. The solution of this flavor problem is perhaps the most

important one facing the soybean industry and must be overcome if the utilization of soybean oil in the food field is to increase.

Progress made in this investigation was accelerated through information gleaned in Germany. The Germans had apparently developed a number of methods which were claimed to produce a practically stable soybean oil. When this technical information became available, one of these German methods was subjected to careful examination. The results thus far obtained indicate that this German method of processing soybeans does inhibit to a large extent the development of an objectionable flavor in liquid soybean oil. These results have aroused the interest of industry and stimulated research activities and processing investigations along similar lines.

Norelac. Two years ago the Bureau reported on the development of a new type of synthetic resin, called Norelac, from soybean oil. This product was shown to have considerable promise as a protective coating and as a heat-sealing and moisture-proofing agent. Work on this project has been completed. Two concerns, in the meantime, have translated the laboratory process for producing the resin to a semi-commercial scale. One of these companies is now planning to erect a factory-scale unit.

Soybean oil paint. Soybean oil by itself is a poor paint oil. For many years it has been used as an extender of good drying oils. Industry has devoted a great deal of attention, without much success, to the development of procedures for improving the drying properties of soybean oil. Research on the development of a method for converting soybean oil to a paint oil was initiated when the Norelac program was terminated. Progress has been made in effecting the desired change in soybean oil. It has been discovered that heating soybean oil in the presence of a special preparation of nickel and carbon markedly increases the drying characteristics of the vegetable oils.

The modified oil, by proper formulation with lime, yielded excellent flat paint films of good durability and low dirt collection. Commercial producers of paints and varnishes are also testing this paint for durability and general utility.

New industrial raw materials from fat acids. The development of a catalyst which imparts greater chemical activity to soybean and linseed oil has led to the preparation of new types of products from these oils. Preliminary studies indicate that compounds which are excellent plasticizers and lubricant additives can be made.

Plywood adhesives. Successful laboratory preparation of a plywood glue containing 40 to 50 percent special soybean meal or high-protein corn gluten and the commercialization of this glue was reported last year. By slight changes in the formulas it was found that this glue could be used in the hot pressing of both soft and hard woods for the production of plywood. These investigations have been extended in order to develop an



adhesive having as its major component soybean or corn gluten meal and which will set when used cold.

Linseed protein investigations. The present linseed oil industry is based on the removal of oil by pressing in hydraulic and expeller equipment. Development of a suitable method of solvent extraction would reduce processing costs and yield a meal suitable for industrial utilization. Preliminary studies have been carried out on the extraction of flaxseed with alcohol, and the extracted meal has been utilized for protein investigations.

Summary of the Work on Soybeans and Other Oilseed Crops: Several contributions on the processing and utilization of soybeans have been made. A new process for the production of soybean products of bland flavor and improved color through the alcoholic extraction of soybeans has been developed. In cooperation with an industrial company, the process was translated to a pilot-plant scale to obtain data necessary for the designing of a plant. Information obtained by Bureau personnel in the investigation of the procedures used by German vegetable oil processing industry for the production of soybean oil of improved flavor stability has been partly evaluated. One German procedure was found to yield a superior product. These findings and the details of the process have been transmitted to American industry. Modification of soybean oil to a product having drying characteristics comparable to linseed oil has been effected. Production of the chemical agent effecting the change in soybean oil is now being carried out on a pilot-plant scale by an industrial company. The new soybean paint oil is being tested by industry for durability and general utility. Cold-setting adhesives containing soybean meal have been developed. These are of promise in the production of large, curved, plywood sections. The soundness of the research program on soybeans is attested by the continued interest shown by industry in the work.

General Administrative Expenses  
(Regional Research Laboratories)

PROJECT STATEMENT

Project	1946	1947 (estimated)	1948 (estimated)
1. General administration .....	113,308	153,440	162,600
Unobligated balance .....	25,932	- - -	- - -
Total available .....	139,240	153,440	162,600
Anticipated supplemental .....	- - -	-16,000	- - -
Total appropriation or estimate..	139,240	137,440	162,600

The general administrative staff has conducted the administrative operations



of supervision and direction of the work of the four Regional Research Laboratories and has exercised the necessary business service control of the organization as a whole.

Frequent conferences have been held with the Directors of the Laboratories in order to maintain a well-coordinated, forward-looking research program, in which post-war research problems will be emphasized. For the purpose of planning the research program, meetings of the Agricultural Experiment Station Relations Committee have been held at each Laboratory, and necessary contacts have been maintained with the Office of the Agricultural Research Administrator and other agencies.

STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Special Research Fund, Department of Agriculture, (Bureau of Agricultural and Industrial Chemistry): Special agricultural chemical researches of a fundamental nature .....	\$77,072:	\$75,700:	\$75,700
Research on Strategic and Critical Agricultural Materials, (Bureau of Agricultural and Industrial Chemistry): Investigations of improved methods for extraction and processing of rubber from guayule and other rubber plants ..	- -:	- -:	179,000
Synthetic Liquid Fuels, Transfer to Agriculture, (Bureau of Agricul- tural and Industrial Chemistry): Construction and operation of semi- works plant for studies of produc- tion of liquid motor fuels from agricultural products. (These funds from Interior Department.) .	72,650:	83,246:	77,128
Emergency Rubber Project, Department of Agriculture, (Bureau of Agricul- tural and Industrial Chemistry): Investigations to develop new or improved processing methods for the manufacture of rubber from guayule plants .....	60,173:	- -:	- -
Working Fund, Agriculture, Bureau of Agricultural and Industrial Chemistry: Advance from War Department: Investigations on the microbiology of eggs and egg products for the Office of the Quartermaster General of the Army	9,200:	- -:	- -

(Continued on next page)

Item	Obligations, 1946	Estimated obligations, 1947	Estimated obligations, 1948
Miscellaneous Contributed Funds,			
Department of Agriculture, (Bureau of Agricultural and Industrial Chemistry): Trust fund deposited by cooperators for research on citrus products - Arizona, California, and Texas .....	6,961:	3,039:	2,500
Penalty Mail Costs, Department of Agriculture (Allotment to Bureau of Agricultural and Industrial Chemistry): For cost of penalty mail pursuant to Section 2, Public Law 364, 78th Congress .....	2,046:	3,000:	3,700
TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL FUNDS .....	228,102:	164,985:	338,028

BUREAU OF HUMAN NUTRITION AND HOME ECONOMICS

Objectives: To determine the kinds and amounts of food, clothing, and other goods and services required in the home for healthful living; to ascertain the relative usefulness and economy of various agricultural products to serve these needs; to develop methods of using these goods more efficiently and effectively; and to collect and interpret information needed to advise on procedures, programs and policies that would assist families to improve their living.

Significance of the Work: Homemaking is the full time job of some 30 to 40 million women. They spend billions of dollars annually for the goods and services used by the Nation's families. What they get for the time and money so spent has an important bearing on the health and well being of the Nation. In large measure their choices determine the market for the products of the Nation's agriculture and industry. Through research the Bureau aims to develop the facts needed to give the homemaker the kind of help with problems of everyday living that other branches of the Government give the farmer, the manufacturer, the merchant, and the wage-earner.

The Bureau's researches serve the homemaker both directly and indirectly. Directly they help her in her selection and use of agricultural and other products and in the efficient management of her home. Indirectly they help in three ways: By indicating the needs of families to producers so they can develop and put better-adapted products on the market; by supplying teachers, extension workers, and others with information of value in helping families with their food, clothing, housing, equipment, and management problems; and by furnishing public leaders with facts and figures that show the needs of the Nation's families and the effect of changing economic conditions on family life.

General Plan: Laboratory studies are conducted to develop information on basic needs of families for food and nutrition, textiles and clothing, housing, and household equipment, and on the nature and relative costs of the goods that can be bought or produced at home to meet these needs. Field studies are made to ascertain the goods and services bought and produced at home and kind of living now had by various groups of the population, and to analyze the effect of such factors as income, prices and supply upon family living.

Wherever practicable, the work of the Bureau is conducted in cooperation with other bureaus of the Department, other Federal agencies, and with State agricultural experiment stations.

Examples of Progress and Current Program: Following are examples of recent accomplishments under this appropriation:

Nutritive value of national food supply: The Bureau completed this year a study of the nutritive value of the civilian food supply from



1909 through 1945. Outstanding facts observe are that during the recent war years, food per person in this country contained more calcium, iron, B vitamins, vitamin A, and vitamin C (ascorbic acid) than at any other time in the 37-year period. Calorie and protein levels during World War II were somewhat higher than in the 1930's, but not above consumption in the decade prior to 1920.

Over the course of the whole period, there was a steady increase in consumption of calcium, vitamins A and C, and riboflavin, one of the B-vitamin group. The rise in calcium and riboflavin is due largely to greater consumption of milk, the rise in vitamins A and C to increased use of fruits and vegetables. Accounting largely for this increase in vitamin C is the more than 4-fold increase in use of citrus fruits since 1909.

Thiamine and niacin (two of the B-vitamin group) consumption were at all-time lows in 1935 coincident with a sharp fall in meat supply, especially pork. Since then these values have been on the upgrade, associated in part with higher meat consumption, and in part with enrichment of a large proportion of flour, bread, and cereal.

A study such as this, revealing trends in national food habits over a long period, furnishes perspective against which to appraise current food supplies, probable effect of food emergencies, and the nutritive value of the food of various nations. This report is of interest to agricultural, commercial, educational and Governmental agencies, and each is finding in it valuable material to guide future programs.

How foods supplement each other in nutritive value: The types and proportions of food combined in everyday meals have an important effect upon the utilization of nutrients. Significant at a time when large segments of the world's population are subsisting upon diets high in cereals, are the Bureau's studies of the effects on growth and development of laboratory animals of diets high in cereal and other foods of plant origin.

When diets containing large amounts of bread, white or whole wheat (up to two-thirds of the calories), along with leafy and root vegetables and small amounts of foods of animal origin, were fed to laboratory animals three types of abnormality developed -- very low storage of vitamin A in the liver as compared with expectation in view of the carotene content of the diet, small weight gains per 1000 calories consumed, and abnormal bone development.

In general, the results were more favorable on diets otherwise identical but including whole wheat bread rather than white. Supplementation with several foods and nutrients are under study. Of those investigated to date the addition of dried skim milk was most effective in improving nutritional condition.

Biological value of protein foods: Typical of studies on the nature of foods themselves is the continuing series on the nutritive value

and the amino acid content of protein-rich foods of both plant and animal origin. This year it was found that the proteins of raw peanut meal have much higher biological values than the corresponding processed product. This suggests that the high temperatures used in industrial preparation of peanut oils are injurious to the nutritive value of the protein of the meals and that corrective measures could improve the quality of this protein-rich food.

More than 30 proteins or protein-rich foods have now been assayed for methionine, a nutritionally essential amino acid containing sulfur, by two chemical methods and a microbiological method previously developed by the Bureau. The results by the three methods are in close agreement. The microbiological method represents a substantial advance in protein analysis. It has advantages in the speed, economy, simple equipment needed, and in the small quantities required for analysis, and is applicable directly to food materials.

School lunch studies: During the past year the Bureau conducted a preliminary study of nine schools, seven of them rural, in three states to ascertain some of the essential characteristics of a successful school lunch program. The information obtained showed wide variations in the cost and kind of food served, and in methods of preparation as well as in facilities of equipment and management practices.

As an aid to the expanded school lunch program, recipes in 100-portion size were selected and tested for palatability and suitability for school lunches. All main dish recipes were made to meet the requirements for the Type-A meal set up by the government for schools participating in the Federal lunch program. The new recipes have been published in cooperation with the Production and Marketing Administration in convenient card form to facilitate use by busy lunchroom cooks. These tested recipes will aid food economy by insuring successful preparation of nutritious food that children like. The form in which they are published will facilitate the calculation of food costs.

Increased calcium in dried eggs: The nutritional role of eggs in the human diet is limited in part by their low content of calcium. While the egg shell is nearly half calcium, both yolk and white are notably low in this nutrient. Inasmuch as dried egg has become a staple product for commercial bakers and may be on the way to home kitchens, it seemed desirable to see whether increasing the calcium content of dried egg by adding ground shell was feasible. In cooperation with the Bureau of Animal Industry a series of studies was therefore undertaken to try out the cooking quality and palatability of the "fortified" product when used in the same way as plain dried egg. It was found that the addition to dried egg of 0.4 percent egg shell ground to pass a U. S. No. 400 sieve, (openings of 0.0015 inch) yielded a product which could be used without detection to the palate in scrambled eggs, custards, ice cream, foundation cakes, muffins, popovers, and yeast rolls. Egg shell particles somewhat coarser than



the 400 sievesize were not detectable in baked custards, in vanilla-flavored refrigerator ice cream, nor in foundation cake and yeast rolls.

New processing methods for home canning: As a result of 3 years of intensive research on home canning methods, new processes for low-acid vegetables, meat, and chicken are now ready for recommendation to home canners. Thus for the first time the Department has at its command a comprehensive body of scientific facts on canning as it is done under home conditions.

Safe procedures have been developed for twelve vegetables commonly canned at home, taking into account variations likely to occur in home canning, such as rate of heat penetration, differences in pack density, initial temperatures inside the jar, and timing during the steps of the processing.

Even with wide margins of safety, these procedures provide in some instances new process times which are considerably less than formerly advocated. For food in pint jars processing times 25 to 50 percent shorter are now recommended. To the 20 or more million American families who annually make a practice of canning some of their food supply in pint jars, these new processing times and lower temperatures will mean home-canned products of higher nutritive value and more appetizing flavor, color, and texture. They will also mean cutting down much spoilage and waste.

The completion of this work on 12 commonly-canned low-acid vegetables, two meats, and one kind of poultry marks a long step forward in improving home-canning processes. Work on other products is under way in cooperation with research groups in Texas and Massachusetts. Also work is under way to see whether more of the attractive appearance and nutritive value of the fresh food can be retained by improved treatment of the food before it is packed into the container, or even by the method of packing itself. Basic to keeping quality and wholesomeness of home-canned fruit and tomatoes, much also remains to be learned about the microorganisms that cause spoilage. These are fields for next study in order to place home canning of all types of food on a sound scientific basis.

Equipment and methods for home freezing foods: The two-point attack on the home freezing of foods includes investigations of the performance and operating characteristics of home freezers and of methods of handling the foods to retain their palatability and nutritive value when frozen and stored for varying periods of time. Broad as the subject is, conspicuous advances have been made in both lines during the past year.

The work on performance of home freezing units is of import to both manufacturers and users of this type of equipment. A home freezer, to be satisfactory, must not only do the initial freezing of the food effectively, but it must provide the right conditions to keep the



Refrozen food so that it retains good eating quality and nutritive value for storage periods as long as from one growing season to another. Moreover, the freezer should be able to repeat this performance year after year and at economical operating cost.

Freezers of basically different design have been studied in the Bureau under engineering-test and performance-in-use conditions, and detailed reports of the results supplied to manufacturers. In many instances these have aided manufacturers in improving their designs and their recommendations to users. Among the most important improvements have been reduction in the size recommended for maximum freezing load and in size of freezing compartment so that the temperature of the food in the storage compartment will not be greatly affected during the freezing of a capacity load.

The Bureau has pioneered in the development of a procedure for testing the performance of home freezers and has taken a leading part in the development of a standard procedure. At its request, the American Standards Association has enlarged the scope of its household refrigeration committee and set up a subcommittee under the co-sponsorship of the Bureau for the development of an American Standard test procedure for home freezers. The adoption of such a procedure in addition to bringing about the better freezer performance in general, will promote a set of uniform criteria and will enable the prospective purchaser to evaluate more easily the statements made as to freezer performance and to select more intelligently among designs and models.

Research of last year showed that during times when freezers were not operating because of power outage or mechanical failure, the temperature of the cabinet rose rather rapidly. This of course may have undesirable effects on the palatability and wholesomeness of foods in the cabinet. Accordingly a study was made to find effective home methods of delaying the warming up of stored frozen foods until repairs might be made. In consequence, the Bureau now has at hand specific tested suggestions for use in emergencies.

Fluctuations in freezer temperatures which occur not only with mechanical failures but when a load of food is being frozen or when the cabinet doors are opened for relatively long periods may affect the quality of the stored food. In cooperation with Cornell University, investigations have been made to determine the effect of such fluctuations on the quality of stored frozen food.

Marked changes in quality were found to occur in frozen food when subjected to temperature fluctuations from 0°F. to 20°F. with the storage compartment at the higher temperature only about one-fourth of the time. The quality of peas, snap beans, and pork roasts was decidedly inferior, approximating the same as that obtained when the foods were stored at a temperature of 10°F. Supplementary work is in progress in cooperation both with Iowa State College and the University of Minnesota. Resulting information has significance to manufacturers for design and for instructions to families on care and use of freezers.

In a study in cooperation with Iowa State College, it was found that the frozen food storage compartment of a household refrigerator should provide temperatures below 10°F., preferably 0°F. to 5°F. in order to maintain desirable quality of frozen food during short period storage.

Better frozen peaches: In order to learn more of the effect of method of preparation for freezing on the quality of the food when frozen and stored, an evaluation, involving more than 700 packages, of the palatability and nutritive value of frozen peaches, partially reported last year, has been completed. Addition of ascorbic acid to the sirup was found to be the most successful treatment for preventing darkening of the fruit and promoting high palatability and nutritive value. A thiourca dip used prior to packaging in sirup or sugar was also successful in preventing darkening but, because its safety to health has been questioned, its use will not be recommended until further information is available. A sodium bisulfite dip, in the concentration used, bleached color and adversely affected flavor. A citric acid dip gave results similar to sirup-packed peaches; some browning and loss of vitamin C occurred, but flavor and texture were satisfactory.

Other conditions were found to affect the quality of frozen peaches. Frozen in slices they maintained better texture but lost more flavor than when frozen in halves. Peeling without scalding gave better results than peeling after scalding in boiling water. The latter resulted in a translucent or cooked layer that sloughed and discolored during storage. Of seven varieties of peaches studied, the Sunhigh ranked highest in flavor throughout storage, while Elberta scored highest in texture and only a little lower in flavor. A soft-fleshed peach, Golden Jubilee, was poorest in quality during frozen storage.

Preparing vegetables for freezing: Continued work with frozen vegetables show the adaptations required for various vegetables and the comparative advantages of different methods of preparation for freezing. Water scalding of peas and cauliflower gave better flavor, texture, and ascorbic acid value in the frozen product than steam scalding. The reverse was true of broccoli, while the two methods gave equally good results with asparagus and snap beans.

The importance of inactivating enzymes is shown by the fact that ascorbic acid in frozen snap beans was destroyed in two to four weeks if the activity of the enzyme catalase was unchecked by scalding. A one-minute scald which inactivated the catalase, but not the peroxidase enzyme, gave good retention of ascorbic acid. A three-minute scald completely inactivated both enzymes but resulted in greater loss of ascorbic acid for other reasons.

Housing needs of farm families: That families on farms need better housing for greater comfort in living and increased efficiency in household operations, is a matter of common knowledge. Also in a general way it is known that they need and want adequate space for



work and recreation, energy-and time-saving arrangement of rooms and of equipment and facilities within rooms, and properly designed closets and cabinets for long- and short-time storage of goods, tools, or equipment. But what is not definitely known are the differences in housing needs of families in various regions due to variation in climatic conditions, the amount and kind of work carried on in farm households, differences in storage needs, and preferences of homemakers as to where they want to carry on different household activities.

In order to get factual information on these regional requirements in farm housing, a short schedule for a field study has been developed and given preliminary test. This schedule is designed to obtain the facts needed for planning adequate storage facilities, work centers, activity areas, and floor layouts for kitchens and related work areas in rural homes.

Another type of information helpful to farm families considering the remodeling of their houses is the experience of others who have done just that within the last 10 to 12 years. Such a study is now under way. It will find what improvements farm families have made, what help they had in planning, how they financed the home improvements, and what major problems they encountered.

Recently 40 families in 5 Ohio counties were interviewed as a pretest for a schedule to be used in gathering information of this sort. During the coming year it will be used with a larger group of families widely scattered throughout the country. Facts disclosed by the Ohio study showed that half of the families had borrowed money, \$300 or more, for their remodeling. Thirteen of the families had used some of their own lumber and thus reduced the cash outlay for materials.

Practically all the families employed carpenters and other skilled workmen, but the men of the family did a great deal of the work themselves and thus reduced the cash outlay for labor. Help with planning the improvements had come from various service agencies, mostly without charge. Only 14 of the families had had floor plans drawn to scale and only one of these 14 employed an architect. Ideas for modernization came from farm journals, magazines, trade publications, and a few, chiefly on kitchen improvement, from extension agents. All these Ohio homes had electricity and a sink with a drain, but furnaces and bathtubs were still lacking in a third or more. A large majority of all existing facilities had been installed since 1934.

Studies on space requirements for farm household tasks are being carried on in the Bureau's laboratories. Since the kitchen is the most used workshop in the home -- the place where farm women spend one-third to one-half of their working time -- any new development in efficient arrangement in this area can do much toward alleviating fatigue. Studies of space requirements for day-by-day food preparation in farm kitchens have shown that the largest amount of working surface needed is for baking. For the preparation of baked goods a minimum counter surface of 24" x 36" is required, but an area of 24" x 42" affords greater ease and convenience.



To bring together in readable form what is now known regarding desirable farm housing features, a series of popular bulletins under the general title "Your Farmhouse" is being prepared in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering. Since more farm families have signified their intention to remodel existing houses than to build new in the near future, first items in the published series are designed to help farm families plan their remodeled dwelling so that it will get them the maximum in comfort and satisfaction for whatever outlay of money and labor they decide to make. In preparation are bulletins on planning the new farmhouse, and planning individual rooms, such as kitchen, utility room, bathroom, bedroom, and living room. A kit with more than 30 plates of "cut-outs" made to scale, depicting floor plans, room arrangements and standard pieces of equipment and furniture has been developed and is being tried out by the Extension Service in conferences on house planning with farm families.

Durability of construction in cotton garments: Durability is an important factor in cotton work garments, whether purchased or made at home. Unfortunately, few data are available from scientific investigations on which to base specifications for details of garment construction that will insure satisfactory wear. The Bureau, in cooperation with the Land-Grant Colleges and the Experiment Stations of Ohio and Indiana, has made significant progress this year along such lines.

An analysis was made of construction features on 46 women's ready-to-wear house dresses to determine present commercial practices. Observation of seams indicated many unsatisfactory features. Mercerized 2-cord thread was used commonly, seam allowances tended to be small, the edges unfinished or pinked, and the number of stitches to the inch small. Out of 46 dresses examined, only 14 were found to have buttonholes with no defects while 32 had from 1 to 10 defective buttonholes. The price of the dress was not a consistent indication of buttonhole quality. Some dresses in the second-lowest price range examined had buttonholes with few defects while on the highest priced dress examined, 4 of 10 buttonholes were defective.

Experimental studies of machine-made buttonholes worked with 3-cord, mercerized thread, size A, showed that when the number of stitches per inch were 30 to 37 as compared to 17, resistance to abrasion more than doubled. Handmade buttonholes improved as stitches were increased up to 55 per inch, the gain being greatest in the buttonhole placed warpwise.

In cooperation with Purdue University, the durability of edge finishes was studied in more than 100 laundry-owned and laundry-washed jackets and uniforms worn by waiters and waitresses. Faced edges on sleeves and fronts were found to wear longer than hemmed edges, and a line of outside stitching increased the durability of faced edges. In general, the stitching on these garments was worn thin or entirely through while the fabrics were still in good condition. Obviously, use of better quality thread would prolong the life of the garment.

How to improve durability through the method of stitching the corners of patch pockets on children's clothes or women's work dresses was given attention this year in cooperation with Ohio State University. Seven methods, including five commonly used on ready-made garments, were tested to see the effect of strain on the stitching and on the fabric to which the pocket was attached. With fabric identical, sewing thread and number of stitches per inch constant, the breaking strength ranged from 6 to 20 pounds among the seven methods tested. A newly devised diagonal method was found nearly twice as strong as the rectangular, the best of the commonly-used commercial methods. A special advantage of the diagonal method is the lessened injury to fabric when subjected to strain. In more than half of the specimens tested there was little or no injury.

Home tailoring of women's garments and clothing conservation: Professional tailoring techniques have been evaluated, simplified, and modified for use with home facilities. These techniques included steps in cutting as well as construction and finishing. Because some of the results obtained by professional tailors are possible only by the use of special pressing devices, homemade equipment was developed for pressing the collar, jacket front, and sleeve, body and top, during construction or in finished garments. Details were incorporated in a bulletin, "How to Tailor a Woman's Suit," as a companion piece to an earlier one on the making of women's coats.

With the development of techniques for the re-use of discarded articles of leather, fur and felt, the Bureau completed its wartime studies on clothing conservation. These studies have yielded seven printed publications, six articles in professional and popular magazines, and six processed publications. To date, over 1,280,000 copies of the printed and processed publications have been distributed. In addition, six different clothing exhibits, prepared to illustrate conservation of materials, have been lent a total of 211 times and are still scheduled for months ahead.

Quality of fabrics in retail markets: The quality of fabrics available to consumers in various parts of the country during recent years is shown by a study of the goods on the retail market.

All-linen and linen-cotton tea towels, representative of those currently available to consumers indicate that all-linen towels lose more of their strength during use than do towels with a cotton warp and linen or linen-cotton filling. The losses in three qualities of all-linen towels were 14, 30, and 50 percent of lengthwise strength after 10 days use and 10 washings; in the part-linen-part-cotton towels, 12 to 23 percent. After 25 washings, some of the linen towels were too deteriorated for laboratory analyses. The inferiority of the all-linen towels was due in part no doubt to the short staple fibers used and to the small amount of twist in the yarns.

Supplies of staple clothing fabrics have been shorter during the early period of reconversion than at any time during the war. Four State cooperating agencies were able to procure only 84 staple cotton



fabrics in the fall of 1945, compared to 135 in the fall of 1944. Instead, they found considerable yardage of luxury materials, such as eyelet embroidery at prices ranging from \$2.95 to \$5.95 or more, per yard. Analyses of 675 fabrics purchased periodically in Minnesota, Pennsylvania, Tennessee, Washington, and the District of Columbia revealed excessive shrinkage in many fabrics, exceeding 3-1/2 to 5 inches per yard in several instances; large amounts of sizing, often as much as 10 percent; and objectionable fading in practically all fabrics.

Protective finishes for cotton fabrics: During the last year the Bureau continued its cooperation with the American Association of Textile Chemists and Colorists on the development of methods for testing mildew resistance of fabrics that correlate with service conditions. A total of 35 fabrics treated with various mildew-proofing agents have been submitted to four different inoculation procedures and weather exposure tests. Strength measurements of the inoculated and incubated strips of the treated fabrics show that the indirect soil-suspension procedure, based on the method developed by the Bureau, was the most severe method of test. It differentiated quickly and accurately among the treated fabrics. In the main, results from this simple 14-day indoor laboratory method agree with those from a direct inoculation procedure on samples after weather exposure for six weeks at Beltsville, Maryland, during summer months, conditions representative of about a half a season of out-of-door weather in this climate.

In order to determine the microorganisms that attack cotton fabrics out-of-doors, cultures were taken from the untreated control fabrics used in the weathering investigations. Fifteen fungi were isolated and their cellulose-destroying ability determined. Three species caused almost complete deterioration.

Knitted cotton fabrics: Continued studies with finishes for cotton hosiery show that for the most part the change in properties was about the same whether a given amount of finish was applied to the yarn before knitting or to the knitted hose.

In developing satisfactory plastic welts for hosiery from medium staple single-ply cotton yarn, laboratory tests show that plain construction knit material had the highest bursting strength and resistance to abrasion, but that the one-way stretch ribbed fabric was the most elastic and maintained the highest percentage of elasticity under the various loads used. These qualities of the rib knit find extensive use in children's anklet hose.

Exploratory to determining the use to which each is best adapted, a comparative study has been made of the properties of fabrics knit from different fibers, using yarns of the same size in fabrics of identical construction. All-cotton fabrics (except those of mercerized carded yarns) were found to be stronger than rayon materials. Nylon fabrics were strongest, silk second. In insulating value, cotton ranked next to wool, while continuous filament rayons were lowest. In water absorption cotton was also intermediate, with



natural cottons more absorbent than mercerized. In resistance to abrasion, cotton knit fabrics ranked second only to nylon, with natural cotton higher than mercerized and combed superior to carded cotton. Cotton and nylon fabrics were less permeable to air than those of other fibers. Cotton and linen ranked lowest in resilience.

Consumer purchases of cotton clothing: Persons interested in potential markets for cotton can learn much from studies of family expenditures. An analysis of family buying of cotton shirts in 1941 revealed that on the average for 100 men, those on farms bought 276 work shirts, in cities, 146. On the other hand, those on farms purchased 104 dress shirts, those in cities, 259. As income increased, numbers of cotton work shirts purchased increased only slightly, whereas purchases of cotton shirts other than for work increased markedly. This was true for farm, village and urban dwellers. The increase in the number of shirts purchased was much greater than in the price paid per shirt. Other differences between the buying patterns of the two groups of men were that urban men bought more, up to three times as many, fine cotton hose, slack suits, pajamas or night shirts, and undershirts, shorts or underdrawers. Farm men, as outdoor occupation would require, bought more heavy cotton socks, gloves, overalls or coveralls, trousers, and union suits made of cotton than did city men.

Studies of family living: Nearing completion is an analysis of the adjustments rural families in Tennessee made to the economic change brought about early in the war. This study, in cooperation with the University of Tennessee was mentioned last year. It showed that Tennessee white farm families in 1944 managed to break even at an average income of \$638. That is, living expenses were met without going into debt or drawing on past savings but no savings were made during the year. The "break-even" point for white rural nonfarm families in a county which had a high rural nonfarm population was \$1,299, more than twice that for farm families in the State.

Food was the largest item of expense for both farm and nonfarm families. Farm families paid an average of \$220 or 29 percent of their total living expenditures for food while nonfarm families spent \$635 or 23 percent. Clothing was second in importance for both farm and nonfarm families.

Estimated average net cash income of white farm families in Tennessee in 1944 was \$1,203. The median income was \$875; that is, 50 percent of the families had less than that amount. Estimated average net money income of white rural nonfarm families in the county studied was \$2,534; the median income was \$2,380. Many of these farm families in 1944 had incomes from sources other than from farm operation - chiefly from wages and salaries. Fifty percent of the families had wage or salary income.

How and where older people live is of concern to an aging population. In 1941, about one in three rural families included at least one person 60 years of age and over, according to a special analysis of

the sample included in a national study of family spending and saving. In farm communities there were more aged men than women, 142 men to every 100 women.

In farm communities about one-third of the persons 60 years and over were elderly couples without anyone else in the family, as compared with one-half in rural nonfarm communities living in such family groups.

Living alone was much more common among elderly people in villages than on farms; 13 percent of all rural nonfarm persons 60 years of age or older lived alone as compared to only 4 percent of the elderly on farms.

About half of elderly couples and persons living alone on farms or in villages had money incomes under \$500 in 1941. Only about 7 percent had incomes of \$2000 to \$5000. In nearly one-fourth of the farm families with elderly persons, these persons were living as dependents, but this was true in only one-eighth of the rural nonfarm families.

These first facts from a study of how older people live in rural communities will be supplemented by information on the kind of food, clothing, and other goods and services these elderly persons purchased, and will be compared with information from other groups. Through such analyses, family expenditure data can be made more useful in advising families on budgeting, and for seeing how different types of families buy and live.

Also under way is a study, made in conjunction with the Department's Quarterly Survey of Agriculture, of expenditures in 1945 for the goods and services needed for living by farm families in different income classes in two regions -- the South and the North Central.

Home economics information: During the year July 1, 1945, to June 30, 1946, there were released 26 printed and processed publications; 18 technical articles for professional journals; 135 popular articles and fact sheets for press and radio use; 24 radio scripts and broadcasts. A list of the printed material is available in mimeographed form.

Included in the total for printed and processed publications are the year's ten issues of "Rural Family Living" -- a digest of current information on prices, supplies, and Government regulations affecting food, clothing, household equipment, and other items important in household purchases. Extension workers, Farmer's Home Administration Home management supervisors, and others working directly with farm families find this service of great help in keeping abreast with the rapidly changing economic situation.

Another noteworthy accomplishment of the year was the production of an educational motion picture on "Freezing Fruits and Vegetables," filmed in natural color, and prepared coincidentally with an illustrated bulletin suitable to be used alone or as "take-home" directions

by the motion picture audiences. A total of 107 prints of the motion picture film are now in circulation by State film libraries, the Extension Service, and other cooperating agencies, and a number of commercial films are placing purchase orders. Many of these same agencies have ordered quantities of the bulletin, and distribution during the two months since issue, already totals approximately 320,000 copies. This dual presentation of facts growing out of the research on home freezing will greatly accelerate the spread to the public of practical and timely information.

The Bureau now has on the list for active distribution 62 popular and 45 technical bulletins. Of these, 4,951,319 copies were distributed during the past year on request of homemakers, professional workers in home economics and allied fields, manufacturers and distributors of consumer goods, and administrators and public officials concerned with programs touching human welfare. This demand for published material indicates a growing awareness on the part of the American public to the need for research applied to the goods and services used in everyday living.

#### STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS

Item	Obligations, 1946	Estimated Obligations, 1947	Estimated Obligations, 1948
<u>Special Research Fund (Allotment to Bureau of Human Nutrition and Home Economics): For special researches in nutrition</u> .....	\$50,326	\$55,900	\$55,900
<u>Administration of the National School Lunch Act (Allotment to Bureau of Human Nutrition and Home Economics): For studies of nutritional requirements of school feeding programs in co-operation with Production and Marketing Administration</u> .....	- -	38,065	57,900
<u>Working Fund, Agriculture (Bureau of Human Nutrition and Home Economics): Advance of funds, pursuant to authority of Sec. 601 of the Act of June 30, 1932 for compiling and furnishing tables of food composition values to the War Department</u> .....	- -	5,000	- -



STATEMENT OF OBLIGATIONS UNDER SUPPLEMENTAL FUNDS - Continued

Item	Obligations, 1946	Estimated Obligations, 1947	Estimated Obligations, 1948
Penalty Mail Costs, Department of Agriculture (Allotment to Bureau of Human Nutrition and Home Economics): For cost of penalty mail pursuant to Sec. 2, Public Law 364, 78th Congress .....	809	1,000	1,250
TOTAL, OBLIGATIONS UNDER SUPPLEMENTAL FUNDS .....	51,135	99,965	115,050

## WHITE PINE BLISTER RUST CONTROL

General: This control program is carried on jointly by Federal, State, and private agencies under the technical direction and leadership of the Bureau of Entomology and Plant Quarantine. The cooperating Federal agencies include the Bureau of Entomology and Plant Quarantine and the Forest Service of the Department of Agriculture and the National Park Service, Bureau of Land Management, and Office of Indian Affairs of the Department of the Interior.

Blister rust control work made rapid progress before the war with emergency relief labor, but during the war years only a holding program was practicable and some ground was lost. Congress recognized this situation and provided increased funds for an expanded blister rust control program beginning with the fiscal year 1947 in order to complete the initial ribes eradication and bring the rework up to date. As a result, the work was expanded beginning July 1, 1946, and continued on an increased scale during the remainder of the 1946 field season. At the beginning of the calendar year 1946, the initial removal of ribes had been completed on about 80 percent of the approximately 28 million acres of control area in the cooperating states, and control of the rust was considered as established on 37 percent of this acreage. About 20 percent of the control area still requires initial ribes eradication, and 63 percent will need one or more reworkings. The remaining work has been increased and made more difficult by changes in the forest cover caused by the harvesting of over 11 billion board feet of white pine lumber for war uses during the 6-year period 1940 through 1945. This is twice the average annual rate of cut for the 5-year period prior to 1940. As the regeneration of pine and ribes occur at about the same time, the prompt application of ribes eradication measures to these cut-over areas is needed to prevent the loss of young-growing stock to the disease.

War conditions continued to handicap the control program during the calendar year 1945 as in previous years, although some sections experienced less trouble than others. In general, the over-all accomplishments for 1945 were somewhat greater than for the previous year, with continued emphasis being placed on needed rework to maintain control of the disease in protected areas. Seasonal labor was employed in all operating regions and totaled about 5,500 persons at the peak of the season. In remote forest areas 88 camps were operated by the cooperating agencies for ribes eradication work, of which 79 were located in the western white and sugar pine regions. In forest areas where camps were unnecessary, the required seasonal labor was obtained in the localities where the work was in progress. Numerous forest fires handicapped the work to some extent. Blister rust workers were the principal source of trained labor in the woods and were frequently called upon for fire duty. As a result, man-days spent on fire suppression were lost to blister rust control work. Competent supervisors and camp cooks were especially scarce and teen-age boys again made up the bulk of the labor used on ribes eradication. This

labor was supplemented to some extent with Mexican Nationals, German internees, civilian public service workers, returned veterans, and older men unfit for war work.

Participating in the program along with the affected Federal agencies are 28 states. Also, counties, townships, timber protective associations, lumber companies, and individuals are cooperating in the control work. State and local agencies increased their contributed funds by about \$85,000, the total for the fiscal year 1946 amounting to over \$364,000. The combined efforts of the several cooperating Federal, State and private agencies resulted in the eradication of 18,938,829 ribes on 1,018,882 acres of forest land, of which 598,254 acres were rework and 420,628 initial eradication. The latter, however, includes 213,123 acres which were found to be ribes-free on the initial examination. Most of the ribes eradication, therefore, was concentrated on needed rework to maintain control in protected areas. A summary of results accomplished during the calendar year 1945, by regions, operating agencies and land ownership, is given in Tables 1 to 3. The status of control through 1945, by land ownerships and regions, is given in Tables 4 to 7.

#### Examples of Recent and Current Program Activities:

##### Bureau of Entomology and Plant Quarantine

The Bureau continued to provide the leadership, over-all planning, coordination, and technical direction needed to unite the work of all cooperating agencies into a uniform field program. In cooperation with participating agencies, field examinations were made to select white pine areas for protection on the basis of pine stocking, ribes population, and status of the rust. These areas were classified as to priority for working on further examination, according to their lumber-producing potentialities in relation to the feasibility of required control work. White pine stands in parks or other non-timber producing areas were selected on the basis of their aesthetic, scenic and recreational values.

Seasonal workers were trained and technical supervision was given to their work, to obtain maximum production and to maintain effective standards of ribes eradication. Cooperative blister rust control work on State and private lands was advanced during 1945 by the eradication of 6,299,963 ribes on 773,709 acres, of which 275,826 acres were initial work and 497,883 rework. Removing these ribes was of primary importance in protecting pines on state and private lands, but in some regions where these lands are intermingled with Federal lands, the work also afforded protection to pines in Federal ownership. The status of the work at the end of 1945 is shown in Table 4.



Many white pines of high ornamental, recreational, and forest value have been attacked by blister rust within the infected regions. These trees can be saved, when the disease has not progressed too far, by cutting out the infected parts. Blister rust cankers were removed from 292,392, infected white pines to save them from being killed by the disease. This includes canker elimination in small centers of pine infection in the sugar pine region, to prevent rapid intensification of the rust and to retard its southward spread.

Ribes eradication was carried on around 19 nurseries to protect over 43,650,000 young pines growing in nursery and transplant beds. In this work 48,191 ribes were destroyed on 8,688 acres to maintain blister rust protection and assure rust-free stock for forest planting. A number of nurseries and their environs are now practically ribes-free and are maintained in this condition by periodic inspection and by reworking any portions on which ribes reappear and endanger the pine.

Work on the development and improvement of control measures was continued in the western white and sugar pine regions, where a solution is being sought for several troublesome control problems. Significant improvements were made in herbicidal methods for ribes eradication and in the coordination of control methods with pine management.

Field trials of power sprayers in applying herbicides to ribes in California and Idaho indicated these methods may speed the establishment of control on cutover lands. The results of ribes ecology studies in Idaho are being put to practical use in evaluating ribes regeneration in relation to western white pine logging and management practices and surveys on proposed timber sales have been made for the purpose of coordinating cutting practices with blister rust control.

Blister rust has been reported from 28 states, and occurs in more or less abundance in the principal white pine timber producing areas in the eastern and western white pine regions and the northern half of the sugar pine region. In northern California its known range was extended eastward during calendar year 1945 into the southern Warner Mountains, Modoc County, where the rust was found for the first time on Ribes petiolare within the Modoc National Forest. Climatic factors necessary for the spread and intensification of the rust in the Pacific Coast region were generally unfavorable, but in the western part of the Klamath National Forest, R. sanguineum bushes had from 50 to 100 percent of their leaves infected with blister rust, while elsewhere on this forest ribes infection was generally light. In the Sierra Nevada numerous infected ribes were found at the southern end of the Shasta and the northern end of the Lassen National Forests, where the rust appeared to have intensified on ribes to a greater extent than it had elsewhere. Infected ribes leaves were obtained from the southern Eldorado National Forest for the second consecutive year, and four new pine infection centers of 1938 origin were located and destroyed on the Lassen, Plumas, and Shasta National Forests within the previously known infected areas.

In the Northwestern region no blister rust infection was found on white pine or ribes beyond its previously known distribution. Weather conditions in the spring of 1945 were ideal for spread of the rust from pine to ribes, but the heavy initial infection of ribes was largely dissipated by a long period of dry, hot weather continuing from late June to late August.

In the North Central region ribes infection was found for the first time in 22 counties in the states of Illinois, Indiana, Iowa, and Ohio. Infected white pines were found for the first time in Crawford and Ogemaw Counties, Michigan. As in 1944, the greatest extension of the rust into new areas occurred in Iowa, where infected ribes were found in 12 new counties. The amount of infection on white pine has increased considerably in northern portions of the region during recent years and numerous cankers of 1941 and 1942 were observed in 1945.

In the Southern Appalachian region two centers of infected white pines were discovered in Grayson County, Virginia, and late in the summer a small area of diseased white pine was discovered in northwestern Ashe County, North Carolina. The latter is the first area of infected white pines found in that State. Blister rust infection was reported for the first time from Anne Arundel and Cecil Counties, Maryland, on cultivated ribes.

In the Northeastern region blister rust is generally distributed and ribes eradication has been progressively extended within the white pine area over a period of many years. Control of the disease has been established in those parts of the worked area on which these bushes have been so reduced, as a result of ribes eradication, that a serious rust hazard to the pines no longer exists. Continued suppression of ribes will keep them on the decline and maintain effective control of the disease. The spread of the rust from ribes to pines has continued in unprotected areas, as well as in those parts of the protected areas where these bushes have not been kept sufficiently suppressed to control the disease. The spread in these protected areas is due to unavoidable delays in scheduled reworkings and to logging and other disturbances which bring about the regeneration of pine and ribes.

The examination of nursery stock en route at key transfer points in the United States was continued as the primary means of securing compliance with the Federal domestic quarantine on account of white pine blister rust. These restrictions have been instrumental in retarding the spread of the disease. Control measures are being applied cooperatively on a large scale in both infected and non-infected white pine states. Current quarantine measures are designed (1) to protect two pine growing regions in which the disease has not yet become established; one comprised of Arizona, Colorado, Nevada, New Mexico, Utah, Wyoming, and part of California, and the other, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee; and (2) to control the shipping of currant and gooseberry plants into 23 states which maintain blister rust control areas and in which the planting and growing of these plants in specified areas is prohibited as a measure of protection to white pine stands.

### Forest Service

Control work is conducted on several of the National Forests in the three major white pine types. The eastern white pine in the Appalachians and the Lake States is a key species in rebuilding these old cut-over areas into productive forests. Western white pine in Idaho, Montana and eastern Washington is the prime support of the forest products industries in the Inland Empire and sugar pine is the most valuable species in the mixed conifer forests of California and southern Oregon. In these three types, the initial control work on national forests has covered 3,189,390 acres out of the present estimated control area of 4,430,733 acres. This leaves 1,241,343 acres still to receive initial ribes eradication as of January 1, 1946 of which 1,077,155 acres are in the West, with 354,387 acres in the western white pine region and 722,768 in the sugar pine region. In addition, 849,145 acres require one or more reworkings to establish control of the rust on a maintenance basis. During the calendar year 1945 in the face of many handicaps resulting from the war, 10,321,158 ribes were destroyed on 209,923 acres with 86,976 man days. Of this acreage, 81,057 acres were rework, and 128,866 initial eradication.

In the eastern National forests the important job is to maintain the areas already covered and extend the work to cover white pine areas which have not been initially protected. Nearly all of this acreage is on national forests located in the Southern Appalachian and Lake States. A total of 147,242 acres was worked in 1945, of which 36,874 acres were rework and 6,703 initial eradication. The remaining 103,665 acres did not require any crew work because they were found to be free of ribes on the initial examination. This ribes-free acreage is located in the Southern Appalachian States, where rapid coverage is possible because of the absence of these bushes in many pine-producing localities. In these States initial ribes eradication was performed on 3,006 acres and rework on 24,900 acres. In the Northeastern States the work was primarily of a maintenance nature to insure the continued effectiveness of past control work. In the National forests of the Lake States, rework was performed on 11,934 acres and initial eradication on 3,697 acres. In this region there is estimated to be 134,235 acres still in need of initial ribes eradication. The status of work at the end of 1945 is shown in Table 6.

### National Park Service

Continued progress was made in the application of control measures on lands under the jurisdiction of the Department of the Interior. Control operations conducted by the National Park Service during the calendar year 1945 resulted in the eradication of 1,137,985 ribes on 24,346 acres, of which 9,150 acres were initial eradication work and 15,196 rework. The bulk of the control work was accomplished in the sugar pine and western pine regions where the major rust problem on National Park lands is located. Also, control work was continued where needed in the National



Parks in the Northeastern and Southern Appalachian States to maintain control of the disease. A survey of host-plant associations, potential rust hazard and possibilities of control in the Grand Tetons indicated such low pine values, favorable rust spread conditions, and high control costs, that a decision was made to undertake no ribes eradication work in that area. Five-needle pines form an important part of the forest cover in 13 National Parks and the Blue Ridge Parkway. As the disease becomes more widespread each year, it is imperative to protect the pines within these nationally important areas in order to save them from destruction by blister rust. The status of the work at the end of 1945 is shown in Table 5.

#### Bureau of Land Management

Work was continued on revested Oregon and California Railroad and Reconveyed Coos Bay Wagon Road grant lands, under the jurisdiction of the Bureau of Land Management. During the calendar year 1945, 196,857 ribes were destroyed on 2,911 acres, of which 1,883 acres was initial eradication, and 1,028 rework. These forests are managed on a sustained yield basis and considering there is over a billion feet board measure of highly valued five-needle pines on O&C lands, any extensive blister rust losses would greatly reduce the potential commercial value of these lands and disrupt management plans. The status of work at the end of 1945 is shown in Table 5.

#### Office of Indian Affairs

A survey of the forest area in the Wind River or Shoshone Reservation in Wyoming showed pine values were too small to justify control work, and this reservation was eliminated from the control program. The Indian reservations with commercial white pine areas lie within the Lake States. During the calendar year 1945, 1,066,729 ribes were destroyed on 7,947 acres, of which 5,541 acres was initial eradication, and 2,406 rework. The total stumpage value of the five-needle pines within the forests of 12 Indian reservations is estimated to be approximately two million dollars. In addition there is a considerable acreage of young growth forming the next potential crop. Control work is essential, if this natural forest resource is to be protected, and continued under sustained yield management for the benefit of the Indians. The status of work on Indian reservations at the end of 1945 is shown in Table 5.

Table 1 - Ribes Eradication Work by All Cooperating Agencies  
During the Calendar Year 1945  
(Initial and Reeradication)

Region	Initial Eradication (Acres)	Reeradi- cation (Acres)	Total (Acres)	Effective Labor (Man-days)	Ribes Destroyed (Number)
Northeastern	82,422	414,825	497,247	31,607 <sup>1/</sup>	2,147,268
Southern Appalachian	218,881 <sup>1/</sup>	35,770	254,651	12,467 <sup>2/</sup>	1,389,317
North Central	83,907	69,253	153,160	23,299	3,043,605
Northwestern	12,415	38,863	51,278	65,921	6,403,120
Pacific Coast	23,003	39,543	62,546	51,624	5,955,519
Total -	420,628	598,254	1,018,882	184,918	18,938,829

<sup>1/</sup> Includes 213,123 acres found Ribes-free.  
<sup>2/</sup> Includes 1,904 man-days blocking out Ribes-free acreage.

Table 2 - Summary of Acreage Worked in 1945 by Operating Agencies  
and Regions (Initial and Reeradication)

Operating Agencies	Initial Eradication (Acres)	Reeradi- cation (Acres)	Total (Acres)	Effective Labor (Man-days)	Ribes Destroyed (Number)
Federal:					
National Forest	128,866	81,057	209,923	86,976	10,321,158
O&C Revested Lands	1,245	1,712	2,957	3,104	112,994
National Parks	9,150	15,196	24,346	14,517	1,137,985
Indian Reservations	5,541	2,406	7,947	6,464	1,066,729
Sub-total: Interior	15,936	19,314	35,250	24,085	2,317,708
Total - Federal	144,802	100,371	245,173	111,061	12,638,866
State and Private	275,826	497,883	773,709	73,857	6,299,963
Grand Total	420,628	598,254	1,018,882	184,918	18,938,829

Table 3.- Summary of Acreage Worked in 1945 by Land Ownership

Ownership	Eastern White Pine Region (Acres)	Western White Pine Region (Acres)	Sugar Pine Region (Acres)	Total (Acres)
<u>Federal:</u>				
National Forest	157,401	32,095	21,765	211,261
O&C Revested Lands	-	-	2,911	2,911
National Parks	4,716	5,101	14,856	24,673
Indian Reservation	7,947	-	-	7,947
Sub-total: Interior	12,663	5,101	17,767	35,531
Total - Federal	170,064	37,196	39,532	246,792
State and Private	734,994	14,082	23,014	772,090
Grand Total	905,058	51,278	62,546	1,018,882

Table 4 -- Progress of Ribes Eradication on State and Private Lands through 1945

Region	Total Acres Control Area	First Working		Second Working		Other Workings		On Maintenance		Remaining Work	
		Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Unworked Acres	Requiring Re-work-acres
Northeastern	12,326,059	10,664,761	86	4,581,559		640,098		2,861,608	23	1,661,298	7,803,153
So. Appalachian	4,675,050	4,613,639	99	113,914		25,627		4,301,824	92	61,411	311,815
North Central	3,481,839	2,478,455	71	663,003		63,371		614,002	18	1,003,384	1,864,453
Subtotal: East	20,482,948	17,756,855	87	5,358,476		729,096		7,777,434	38	2,726,093	9,979,421
Northwestern	1,180,077	695,026	59	162,945		43,714		241,949	21	485,051	453,077
Pacific Coast	1,044,910	452,693	43	160,759		34,434		187,797	18	592,217	264,896
Subtotal: West	2,224,987	1,147,719	52	323,704		78,148		429,746	19	1,077,268	717,973
Grand Total	22,707,935	18,904,574	83	5,682,180		807,244		8,207,180	36	3,803,361	10,697,394



Table 5 - Progress of Ribes Eradication on Department of Interior Lands through 1945

Region	Total Acres		First Working		2d Working		Other Workings		On Maintenance		Remaining Work	
	Control Area	Acres	Per Cent	Acres	Acres	Acres	Per Cent	Unworked Acres	Requiring Re-work Acres			
NATIONAL PARKS												
Northeastern	16,872	16,872	100	11,271		4,979		16,872	95	-	-	
So. Appalachian	122,974	120,149	98	5,964		2,841		106,410	86	2,825	13,739	
North Central	120	120	100	-		-		-	-	-	120	
Subtotal: Eastern	139,966	137,141	98	17,235		7,820		123,282	88	2,825	13,859	
Northwestern <sup>1/</sup>	22,476	8,701	39	5,742		7,158		6,600	29	13,775	2,101	
Pacific Coast	287,694	95,259	33	24,926		1,309		33,189	12	192,435	62,070	
Subtotal: Western	310,170	103,960	34	30,668		8,467		39,789	13	206,210	64,171	
Total - Nat'l Parks	450,136	241,101	54	47,903		16,287		163,071	36	209,035	78,030	
O & C REVESTED LANDS												
Pacific Coast	129,709	40,659	31	1,118		-		22,698	17	89,050	17,961	
PUBLIC DOMAIN LANDS												
Northwestern	29,409	16,717	57	5,900		1,366		5,509	19	12,692	11,208	
INDIAN LANDS												
So. Appalachian	445	445	100	-		-		445	100	-	-	
North Central	105,698	82,862	78	47,739		3,697		9,579	9	22,836	73,283	
Total - Indian Lands	106,143	83,307	78	47,739		3,697		10,024	9	22,836	73,283	
GRAND TOTAL	715,397	381,784	53	102,660		21,350		201,302	28	333,613	180,482	

<sup>1/</sup> Includes Mt. Rainier 3,581 acres, Glacier 4,728, Yellowstone 7,167, and Rocky Mountain 7,000. The latter acreage is indefinite and may not be undertaken.

Table 6 - Progress of Ribes Eradication on National Forest Lands through 1945

Region	Total Acres Control Area	First Working		2d Working		Other Workings		On Maintenance		Remaining Work	
		Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Unworked Acres	Requiring Re-work Acres
Northeastern	6,752	6,146	91	4,138		3,255		2,513	37	606	3,633
So. Appalachian	1,508,106	1,478,759	98	54,606		11,669		1,362,774	90	29,347	115,985
North Central	405,062	270,827	67	84,941		11,869		109,062	27	134,235	161,765
Subtotal: Eastern	1,919,920	1,755,732	91	143,685		26,793		1,474,349	76	154,188	281,383
Northwestern	1,401,414	1,047,027	75	243,991		48,835		355,328	25	354,387	691,699
Pacific Coast	1,109,399	386,631	35	180,592		58,226		229,185	21	722,768	157,446
Subtotal: Western	2,510,813	1,433,658	57	424,583		107,061		584,513	23	1,077,155	849,145
Total	4,430,733	3,189,390	72	568,268		133,854		2,058,862	46	1,241,343	1,130,528
Rocky Mountain (Colo. & Wyo.) <sup>1/</sup>	421,000	36,619	9	1,962		-		17,000	4	384,381	19,619
GRAND TOTAL	4,851,733	3,226,009	67	570,230		133,854		2,075,862	43	1,625,724	1,150,147

<sup>1/</sup> Experimental work with WPA labor to determine feasibility of control - Remaining work indefinite.

Table 7 - Progress of Ribes Eradication on Lands in all Ownerships through 1945

Region	Total Acres Control Area	First Working		2d Working		Other Workings		On Maintenance		Remaining Work	
		Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Unworked Acres	Requiring Re-work Acres
Northeastern	12,349,683	10,687,779	86	4,596,968		648,332		2,880,993	23	1,661,904	7,806,786
So. Appalachian	6,306,575	6,212,992	98	194,484		40,137		5,771,453	91	93,583	441,539
North Central	3,992,719	2,832,264	71	795,683		78,937		732,643	18	1,160,455	2,099,621
Subtotal: Eastern	22,648,977	19,733,035	87	5,587,135		767,406		9,385,089	41	2,915,942	10,347,946
Northwestern	2,633,376	1,767,471	67	418,578		101,073		609,386	23	865,905	1,158,085
Pacific Coast	2,571,712	975,242	38	367,395		93,969		472,869	18	1,596,470	502,373
Subtotal: Western	5,205,088	2,742,713	53	785,973		195,042		1,082,255	21	2,462,375	1,660,458
Total	27,854,065	22,475,748	81	6,373,108		962,448		10,467,344	38	5,378,317	12,008,404
Rocky Mountain (Colo. & Wyo.) <sup>1/</sup>	421,000	36,619	9	1,962		-		17,000	4	384,381	19,619
GRAND TOTAL	28,275,065	22,512,367	80	6,375,070		962,448		10,484,344	37	5,762,698	12,023,023

<sup>1/</sup> Experimental work with WPA labor to determine feasibility of control - Remaining work indefinite.















